

ANIMAL KEEPERS' FORUM

Special Dedicated Issue on Crisis Management in Zoos

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About the Cover

In October of 2003, America's Teaching Zoo at Moorpark College was threatened by a Southern California wildfire. This dramatic shot shows the wildfire as it raced across the hillsides near the college prompting the evacuation of most of the zoo's 200 animals by staff and students. See inside this issue for the story of how they dealt with this crisis at their facility (pgs. 523-528). Photo provided by Chuck Brinkman IV, a professor in the EATM program at Moorpark.

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Acknowledgements

A publication of this sort does not come into being without the hard work and cooperation of many people. I would first of all like to express my gratitude to Bill Baker, my co-editor, for his dedication and commitment to this project. His advice and support throughout the process of contacting authors, gathering information, and working on the final formatting of this issue were invaluable.

To all of the authors who offered their work to be included in this special issue, my sincere thanks. They have taken their knowledge, research efforts and, in many cases, their personal experiences in the field of crisis management and generously shared them to make this volume a valuable resource for the zoological community.

My thanks to those who submitted photographs for inclusion in this dedicated issue for sharing the images that help to illustrate the variety of crisis situations with which a zoo or aquarium might be confronted. Special thanks to Chuck Brinkman from Moorpark College for his dramatic cover photo of the southern California wildlifes.

To the AAZK Board of Directors my thanks for their support of this project and for their belief in the philosophy that knowledge is to be shared, and that we all benefit in the process.

And speal thanks to my husband Gary, for his suppport and understanding as I worked evenings and weekends to get this issue to the printers by deadline.



Susan D. Chan, AKF Managing Editor



33rd Anniversary - 1974 - 2007

MISSION STATEMENT

American Association of Zoo Keepers, Inc.

To provide a resource and a forum of continuing education for the animal care professional and to support zoo and aquarium personnel in their roles as animal care givers, scientific researchers, public educators and conservationists. To promote zoos and aquariums as cultural establishments dedicated to the enrichment of human and natural resources; to foster the exchange of research materials, enrichment options and husbandry information through publications and conferences which will lead to a greater understanding of the needs and requirements of all animals.

Preface

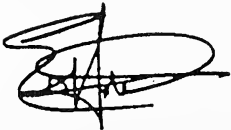
A crisis is defined by the moment. Eventually, in every animal facility, there is a time when that moment arrives. It is therefore paramount that we practice forward thinking and plan for the eventual crisis.

Equally important once we plan, we must train our employees to act within the plan. Employee knowledge, training and practical exercising of each response plan are critical elements of Crisis Management. Employee training is no different than animal training - it should be brief, engaging, consistent, ending with reward. When consistent employee training is provided, employees will act instinctively, rather than impulsively.

Facilities must have the traditional plans for animal escape and response, medical and weather events, but in the eight years since the publication of the first installment of the *Resources for Crisis Management in Zoo and Other Animal Care Facilities*, the world in which zoos and aquariums operate has changed dramatically. As an entertainment destination, our crisis management plans must now include response to terrorist threat, biohazard deployment response and a planned response to a threat from a visitor or employee discharging a weapon, not to mention response to emerging diseases.

It can never be overstated that primary in building an emergency response plan is to plan with your local emergency services. By including the local emergency authorities in your planning, you are working towards ensuring that your facility has an equal role when it comes to Incident Command and Response.

Compiling response plans is a complicated and difficult task, and some elements of that task may be outside the realm of your expertise. This compilation of articles, written by your peers, is assembled to assist you in the task of creating or updating your plans. If you combine these articles appearing here in the *Animal Keepers' Forum*, with the excellent information compiled in our initial publication, you will have the critical resources needed to manage the eventual crisis we all know will arrive sooner than we think.



Ed Hansen
Executive Director
American Association of Zoo Keepers, Inc.



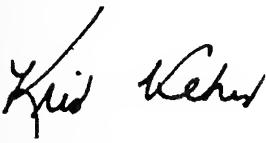
Forward

Congratulations once again to the American Association of Zoo Keepers and all who participated in this extraordinary dedicated issue of *Animal Keepers' Forum*. The first publication in 1999 contained invaluable information from many different perspectives enabling zoos and aquariums to add to their own crisis management plans and apply the wisdom and "best practices" of those who had been through disasters of all kinds.

The publication of this special issue of *AKF* on crisis management has been delayed by one of the most devastating disasters in memory—Hurricane Katrina—and as I write this, the October 2007 wildfires in the hills throughout Southern California are just now being contained. It is important for zoo and aquarium professionals to have access to the most up-to-date information on all the aspects to be considered when responding to a crisis. This publication, along with the original *Resources for Crisis Management in Zoos and Other Animal Care Facilities*, will serve as that all-encompassing reference tool.

We have learned that we will be judged by our response to the inevitable crises that will confront us and this is as it should be. The study of this collaborative effort of so many who share a passion for protecting wild creatures and wild places will give all of us who have animals in our care our best chance to retain the public trust when we are called on to face disaster.

Thanks to the American Association of Zoo Keepers for taking the leadership role in again publishing this valuable resource.



Kristin L. Vehrs
Executive Director
Association of Zoos and Aquariums

**ASSOCIATION
OF ZOOS &
AQUARIUMS**

Introduction

It was a normal day until the radio call came in with a Code Red. In an instant your pulse and breathing quickened. Trying not to break into a run you made your way to the rally point at the equipment room and, at the same time, the radio jumped from your belt into your hand by pure reflex. In the calmest voice possible you checked in while rounding the corner past the kudu exhibit and then you're there at the door. The deadbolt flicked open quickly under your key and into the room you go.

With a touch of hope and a sense of need you approach the gun safe, unlock it, confirm the number, and then grab the rifle. Deftly the action cycles as you glance down towards the chamber and load up as your fellow teammates enter the room. Stepping back and flicking the ammunition box open, the rounds fly from your fingertips into the chamber. As the team gathers their equipment they look to you for guidance. You simply comment, "Lock and load then proceed in an alpha configuration to the site".

As the team moves out, you pull your radio once again from your belt asking for a current situation report from the area supervisor at the event site. She confirms that both of the lions are still at the scene over the body of the zoo keeper who was working the area that morning. For a brief moment you consider that he was in the group that you went to lunch with last week. This thought fades as the radio confirms that all of the visitors are safely inside of the buildings and that the facility has been sealed.

The team spreads out into an arrowhead formation and then slowly separates to their pre-assigned positions forming a perimeter. The supervisor runs towards you at a slow trot as the team reaches the event site. Quickly, between broken breaths, she explains the situation and brings you up to speed. Information is instantly relayed to your teammates as you adjust the radio into headset mode. Time is of the essence, as the service vehicles are only make shift barriers at best.

Over her shoulder you notice movement and then a yell carries on the wind. Breaking into a run you round the nearest service vehicle, and in the near distance you observe the lionesses advancing on a nearby staff member who was keeping watch. With no time, the rifle flies to your shoulder and the cross hairs settle into position. You realize in the corner of your mind that you promised yourself that this day would never come as your finger settles on the trigger and you quietly say a prayer.

As the dream breaks, you sit up in bed and wipe the beads of sweat from your forehead and the realization sinks in that it was only a nightmare. Your feet slowly slide off the bed to the floor as you make your way to the kitchen and pour a glass of water. Walking back towards the porch, you look quietly out into the night as your heart slowly finds its rhythm again. The dawn is still many hours distant, but that's alright, the night brings its own sense of peace.

Quietly you remind yourself that while crisis management is still a young science, less than 20 years old if that, it still has come light years since its inception. In truth, you know that the staff is well trained and that they know their jobs well. You're assured that your facility has one of the best safety records in the industry. Still, you realize that the potential is there for an accident, that it's not a matter of if, but when.

Even if it's not animal-related, what about natural disasters, engineering failures, wildfire, or acts of terrorism? Certainly the future is uncertain, but that's where the training and skill of the staff and the Emergency Response Team comes into play. They have trained, been through practice drills for every contingency, and you feel confident that they could handle the surprises that life throws at us all. Even so, surprise aside, you know that a talented group of animal professionals can adapt and overcome. We have learned from the lessons of the past and we, like our animal charges, have evolved.



W.K. Baker, Director
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Crisis Management Planning in Zoological Institutions

By Geoff Underwood
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Introduction

Disasters and crisis events impact upon the lives of many thousands of people each year. Within minutes, a disaster can rip apart a community or place of work and change the lives of the people it affects forever. Those who understand disasters and know what to do before and after a disaster hits can significantly reduce the impact of the event. These guidelines have been written as a result of firsthand experiences gained at Tidbinbilla Nature Reserve (Canberra, Australia). In addition, I convened a workshop on Disaster and Emergency Planning at the 1st International Congress of Zookeeping held from 4-7 October 2003 at Avifauna in the Netherlands. The results of this workshop have also contributed to the writing of this document.

On 18 January 2003, a wildfire driven by winds exceeding 160 km/hour swept through the 5,500 hectares that make up the Tidbinbilla Nature Reserve, incinerating all that lay in its path. The fires then continued on to the suburbs of Canberra, destroying more than 500 homes and other buildings and blackening the landscape. In the aftermath of this disaster the scene that confronted me within the Reserve can be best described by comparing it to the images of the effects of the atomic bomb on Hiroshima and Nagasaki during the Second World War. More than 75% of the Reserves' captive wildlife and around 90% of the free-range wildlife had been killed or critically injured. Almost all of the facilities we relied upon on a daily basis to service the Reserve and its wildlife had been burnt to the ground and associated equipment totally destroyed – not even my own home had been spared.



Koala Enclosure - a view of our Koala enclosure the day after the fire struck – out of 25 Koalas held in this enclosure only one (miraculously) survived but was severely burned (dead animals can be seen in the photo). (photo by G. Underwood)



Animal House Road - shows how everything was totally consumed by the fire, leaving only blackened tree trunks and rocks behind. (Photo by G. Underwood)

Recent years have seen a number of major natural and manmade disasters and emergencies occur in various parts of the world. Wildfires, earthquakes, floods, tsunamis, landslides and other natural events along with utility breakdowns, environmental spills, engineering failures and acts of violence have all impacted upon people going about their normal daily lives. The one common factor with all of these events is that the timing and extent of the devastation wrought by these tragedies are unpredictable: no one knows when or where the next disaster will occur. So how do you prepare yourself for the unknown, and ensure that the actions you take in the aftermath of a disastrous event are carried out in a safe, effective and constructive manner? You plan for it!

The writing of a comprehensive “Crisis Management Plan” will not prevent a catastrophic event. However, the forward planning process and the identification of key operations, functions and the backup processes you put into place will assist in ensuring the safety of staff and visitors, reduce the impact of the emergency upon the operation of your facility, help ensure the welfare and minimize the emotional effects it will have upon your colleagues and ultimately ensure the best possible care for your captive collection during the aftermath of the emergency. In many regions the production of a crisis management plan is a regulatory requirement, however even if such a plan is not required by law, every institution should have a comprehensive crisis management plan in effect, and all staff working in the institution should be familiar with it. It has often been said that “disasters only occur when hazards meet vulnerability”.

Finally, always remember the principle of Murphy’s Law: “If something can possibly go wrong then it will, and at the worst possible time”. And also remember that if for some reason Murphy’s Law fails to operate, then it’s probably building up for something really big!

The Basics

There are three basic components to any crisis management plan:

- Readiness
- Response
- Recovery

In the development of a crisis management plan you must go through a process whereby you:

- Evaluate your institution's specific risks and vulnerabilities
- Identify the personnel and resources required for an effective response
- Create an effective communications and warning system, including a clearly designated chain of command
- Test your plan through responding to a simulated crisis event
- Have in place the actions to be taken during the recovery phase of the crisis

A comprehensive crisis management plan will provide the basis for a planned response that will ensure that staff reacts to an emergency situation in a manner that will ensure the safety and well-being of:

- Staff
- Captive wildlife
- Visitors
- Auxiliary staff (e.g.: contractors)
- The environment
- Surrounding communities
- Facilities and property

The support of senior management and the involvement of all employees at your institution in the development of your crisis management plan will be critical to the success of the plan, and the use of professional services in reviewing your plan and identifying any weaknesses should also be utilized.

Readiness: What should be included in The Plan?

Crisis events.

One of the difficulties in writing a "Crisis Management Plan" is that you are basically developing guidelines which will be used to deal with an event for which you cannot predict the extent or nature of, and which will occur at some unknown point in time in the future. Whilst some institutions will be able to prioritize the likelihood of specific events occurring as a result of their geographic location or through other means, many institutions will have to plan for a complete range of possible events. All zoological institutions will have a common set of possible events that they should plan for though. These include (but are not limited to):

- | | |
|--|--|
| • Animal escape | • Vandalism |
| • Zoonotic diseases and epidemics | • Vehicular and/or machinery accident |
| • Hazardous biological agents | • Entrapment |
| • Lost persons | • Lightening strike |
| • Death or injury | • Medical conditions (staff or visitors) |
| • Infrastructure fire or flooding | • Dangerous chemicals and/or residues |
| • Robbery/hold-ups | • Bomb or other explosive threat |
| • Animal attack | • Firearm discharge/threat |
| • Power and other utility outages
(e.g. water, gas, phone etc.) | • Gas and/or toxic fumes |
| • Engineering failure | • Bolide impact event |
| • Storm damage | • Poisonings |
| • Individuals being threatened/safety
(assault/hostage etc.) | • Tree fall |

While you may think that the above list is a long one, I should point out that during the past 27+ years that I have worked in the industry, I have personally encountered almost all of them at one time or another. Some institutions will also have to consider the following scenarios, based upon their geographic location and other factors.

These include:

- Wildfires
- Avalanches, land or mud slides
- Earthquakes
- Cyclones, hurricanes, tornadoes or other climatic events
- Ice, snow
- Subsidence and sink holes
- Flood
- Temperature extremes (severe heat or cold)
- Tsunami, storm surge and other tidal events
- Volcanic eruptions, lahars and other associated events
- Radioactive leakage

Hazard Surveys

As your crisis management plan needs to address any and all emergencies that can be reasonably expected to occur at your institution, you will need to perform a “hazard survey” or “risk assessment analysis” to identify your exposure to the various risks. This process should not be confined to the risks contained within your institution, but also recognize the hazards that nearby facilities and other external factors may pose, as well as the hazards that may be posed should a utility or other service provider cease to function.

Based on your hazard survey and assessment, your crisis management plan should then be written for the various emergency scenarios that you might experience.

Minimization Measures

Minimization measures should be developed as a result of your hazard survey to reduce your risk or exposure to possible emergency situations.

Minimization measures include:

- Well structured emergency/crisis management plan: As previously stated, the writing of a comprehensive plan will not prevent a catastrophic event, however the forward planning process you undertake will assist in ensuring the safety and well-being of those affected.
- Adherence to, and training of staff in, safe working practices: This is one of the few measures you can take that will actually reduce the chances of your facility experiencing some types of crisis events. Unfortunately, too many crisis events occur in zoological facilities as a result of poor working practices, and the need to ensure safe working practices are adopted and adhered to cannot be stressed enough.
- Pre-assessment of your facility by fire, police and other external departments: Again, this is one of the few measures you can take that will reduce the chances of your facility actually experiencing some types of crisis events. Most people employed in zoological facilities are not trained emergency service workers or experienced in this field, and the use of trained specialists can highlight potential concerns that may otherwise be overlooked by internal staff.
- Familiarization of police, fire and other departments inexperienced with zoos and wild animals: This process will ensure that your local emergency services are not only familiar with the layout of your facility, but help them to understand specific issues and needs that would be faced in a crisis situation as a result of the unique nature of a captive wildlife facility.
- Weather, fire and other warnings: Ensure that you have a reliable system for receiving these alerts and a process in place for determining at what point your facility should prepare for closure and/or evacuation and other protective measures.
- Sound maintenance program: A well-scheduled maintenance program which regularly inspects facilities and equipment and ensures a rapid repair or replacement of faulty infrastructure will also contribute to reducing the chance of your facility actually experiencing a crisis event as a result of an engineering failure.

How will your captive animals be managed?

As part of the readiness process, the procedures for managing your captive animals should be clearly articulated in the plan and understood by all staff. Whilst the primary concern in this assessment will be for the welfare of the animals, other factors such as the safety of staff, visitors, external agency personnel and surrounding communities will also have to be considered. The management of your animals throughout a crisis situation will be dependant upon factors such as the size and nature of your facility, local regulatory requirements and your institution's fundamental philosophical approach.

One of the questions we had to deal with at Tidbinbilla was whether the captive animals should be maintained in their enclosures throughout the crisis, or released from them. In this instance it should be pointed out that as we primarily displayed native Australian wildlife from the local region, we did not have to generally consider issues such as the establishment of wild populations that were not native to the area (post-emergency); nor were any of the species under consideration of a type which would be considered dangerous to persons in the area. As most of our enclosures were an "open range" type of display, ranging from a couple of hectares to over 30 hectares in size, capture of individual animals was unfeasible given the time we had available before the disaster struck. Given the nature of the enclosures and the risk to any animals released through disorientation and a lack of familiarization with areas outside of their captive environments, the approach we took was to maintain animals within their enclosures and defend these areas from the fires. Post-fire surveys revealed that whilst only approximately 25% of our captive wildlife survived the fires, this percentage was considerably greater than the number of free-range animals that remained alive after the fires, and so vindicated our decision to maintain them within their enclosures.

You should also clearly identify which species will be given the highest priority for protection, as you may find that you will not have the time to protect all of the animals within your collection. Therefore, the plan will need to serve as a template for making decisions about which ones will be afforded the highest level of protection, and which ones may have to take their chances through an emergency situation. Strategies may be implemented for improving the survivability of those animals that are deemed to be of a lower priority (such as the provision of sprinkler systems in the event of a fire) or through confinement to night quarters and the like, however this will vary with the type of crisis you face and the amount of warning you have before the disaster strikes. The process of assessing and prioritizing the protection of animals will be a traumatic process to all those who are responsible for the day-to-day care and welfare of these animals, however this process will be much easier to achieve when done through the crisis management planning process rather than once an emergency situation has struck your facility. Unfortunately, in the disaster that struck Tidbinbilla, all of the "high priority" specimens that we were able to capture and relocate to a "safe facility" prior to the fires were lost when this "safe haven" was also burnt to the ground! The lesson to be learned here is that during crisis events that are broader scale in nature, it would be wise to ensure that any specimens are relocated to a facility that is unlikely to be affected by the same emergency.

As explained in more detail below, you should also consider what options you have if enclosures are severely damaged and unable to house surviving animals, remembering that onsite holding facilities may also have been destroyed or damaged.

Finally, the plan should address the issue of triage and euthanasia of animals that are critically injured. At Tidbinbilla this process was complicated by the fact that we lost our veterinary facility and associated equipment during the fires, and so alternative arrangements for treatment at another facility had to be implemented. The availability of our veterinary staff was also compromised by the fact that they were called upon to oversee assessment and euthanasia of stock from surrounding properties as part of their broader rural community responsibilities.

Don't Assume

Don't assume that the utilities, facilities, resources and equipment that are currently available to you will still be available during and after an emergency, e.g.;

- Power
- Water
- Gas
- Phones (land lines or mobiles)
- Radio and/or pager contact
- Fuel
- Vets and/or veterinary supplies
- Capture and restraint facilities and equipment
- Animal holding and treatment areas
- Food storage facilities
- Food supplies
- Other essential equipment and supplies
- Key members of staff

You need back-ups!

In the aftermath of the 2003 bushfires, it was several weeks before power supply was restored at Tidbinbilla and, as a result, we had no water supply or phone communication facilities. Don't simply rely on back-up plans such as generators for power or the use of mobile phones for communication. In widespread emergencies such as the 2003 fires the surrounding community was in the same situation as we found ourselves, resulting in generators becoming almost impossible to rent and the mobile phone network (which was also partially damaged by the fires) becoming overloaded. Luckily, in our situation we were able to use the vehicle-based radio communication network for communication. However, if your institution does not have such a system you may find it almost impossible to communicate and coordinate response and recovery efforts. In such a situation the basis on which your crisis management plan is established would fail, throwing response and recovery efforts into complete turmoil.

Consider also that enclosures may be severely damaged and unable to house surviving animals – where are you going to hold them? At Tidbinbilla it was surprising what animals did survive, some were unscathed even though they were in a holding enclosure adjoining a building that burned to the ground! Again, don't assume that you will have holding areas onsite, and you may have to have a plan in place for shipping injured and surviving animals to another institution. You should also consider what you would do if you have no capture or restraint equipment. While we had some traps in a storage area that survived the fires, all of our nets, microchip scanners and other equipment were lost to the fires. We were fortunate enough to quickly arrange the use of equipment from other captive facilities from interstate, however the equipment did not arrive on the scheduled flight due to it carrying priority equipment and supplies for emergency agencies that were assisting in the aftermath of the disaster!

Finally think about backup plans in the situation where key members of staff may be unavailable. While the 2003 fires thankfully did not result in the death or injury of any of our staff, some were so traumatized by the event that they were unable to attend work, whilst others lost their homes and were faced with personal losses that precluded them from attending work. We also had several key staff that were reassigned to other duties as part of the broader recovery efforts of the organisation and surrounding communities.

Response: Delegation, Communication and Training

The crisis management plan must clearly articulate the names or positions of those who will be responsible for assessing the degree of risk and response to each crisis event, and what external agencies need to be notified for various types of emergencies. While communication is often seen as an area in which many organizations have room for improvement during the course of normal business operations, this aspect is critical in any effective crisis management plan due to the fact that an emergency event brings with it a range of emotional and other stressful factors to bear upon those involved. It is critical that you get this part of the plan right before an emergency situation

occurs. The plan must also clearly identify what training of staff is needed and the equipment that will be required to respond to emergency situations, and outline how these objectives will be achieved.

The priorities in any response situation should always be:

- Ensure personal safety
- Identify threat situation
- Notification of incident
- Initiate response

Often in a crisis situation individuals may ignore their own personal safety in an effort to respond to the event and there have been many cases where this has resulted in the death or injury of the “rescuer”, which obviously is of little use to those that require assistance (nor to the “rescuer”). Check to ensure that the area is safe for you to enter before rendering any assistance. Also ensure that you have correctly identified the threat situation – again, there have been many instances where the threat was incorrectly identified resulting in the death or injury of “rescue personnel”.

Designate a Leader

During a disaster or crisis, individuals may panic or otherwise overreact, although it will not be obvious in advance as to how individuals will react to a crisis event. When faced with a traumatic event, each person will react differently and the situation can bring out the best and worst in individuals. In the absence of leadership training, problems will inevitably occur, and the chances for personal injury, loss of animals and significant damage to property, equipment and facilities compound quickly. So your first step in preparing for disasters or emergencies should be to have a designated “emergency response coordinator” who is trained to assess the degree of the emergency and to determine the appropriate action. Backup coordinators should also be identified as your identified coordinator may be unavailable due to an inability to get to your facility, or as a result of being injured, killed or otherwise unavailable because of the crisis.

The “emergency response coordinator” will be responsible for overseeing all emergency activities, including the planning process and the selection and training of response team members. In an actual emergency, the coordinator’s duties would include:

- Determining whether a situation requires emergency procedures
- Directing the orderly shutdown of specific operations when necessary
- Evacuating visitors and staff when necessary
- Ensuring that outside emergency services are notified and involved as needed
- Notifying senior management of the emergency and the response taken
- Coordinate response activities (or liaise with external agencies in command)
- Coordinate the recovery process (or liaise with external agencies in command)

The emergency response coordinator should be based in a designated “command center” which also serves as the communications hub. During major emergency utilities such as electricity, water and telephone may become nonexistent and so an alternate area needs to be designated where employees can report to or that serves as a focal point for incoming and outgoing communications. In addition, the coordinator should make this area an alternate “command center” where he or she can be easily reached. Emergency communications equipment such as amateur radio systems, portable public address systems, cellular phones and portable radio units should be available to facilitate communication and response coordination with staff and local authorities.

The incident command structure below the “emergency response coordinator” will be dependant upon the size and nature of your facility, but it must be well defined and capable of responding to all of the possible events identified in your hazard survey, from a small scale, localized emergency right through to a major broad scale incident. It is also imperative that the incident command structure is clearly understood by everyone who works at your facility well in advance of any emergency situation occurring.

Communication.

How are you going to ensure that:

- Your disaster/emergency plan is familiar to all of the current staff and external agencies that will need to know what to do in a disaster situation?
- New staff and external agency members are familiar with correct procedures?
- That everybody is kept up-to-date with any changes?
- Media management is undertaken?

All staff must understand how to respond to any potential emergencies and what role they will play in any response and recovery process. The crisis management plan should be reviewed with all employees when it is initially developed, when employees' responsibilities outlined in the plan change, and when the plan itself changes. The latest version of the plan must be available to all staff in easily accessible locations and a copy of the plan should also be given to each employee during training and new-employee orientations.

The process for reporting emergencies should be included in your plan and clearly explained to all employees. Ensuring that the designated coordinator has been notified of the incident will ensure that the crisis management plan procedures are implemented, that additional assistance and resources are brought to bear if required, and that the safety of all involved in the incident is protected. Remember to include backup systems so that if your phone network or radio system fails, you have a secondary method of communicating and coordinating response and recovery efforts. While it will be necessary to identify external agencies that will need to be worked with in various emergency situations and to list key contacts within the plan, the last thing that you need is for people to have to read through the document to find these details. Emergency telephone numbers, radio call signs, pager details and other emergency contact information should be posted on all communications equipment, bulletin boards and other conspicuous locations. It may also be necessary to notify other essential team members during off-duty hours, so an up-to-date list of essential personnel in order of priority should be available.

Specific instructions for closing down specialized equipment and facilities and ceasing normal business activities should be incorporated into the plan, and specific evacuation procedures including means of accounting for staff and visitors after an evacuation need to be documented. Designated meeting points, command centers and staging areas should also be identified and clearly marked on maps of your facility along with emergency escape routes and "safe areas".

Following an evacuation, the emergency response coordinator will need to know when all personnel have been accounted for. This can be difficult during shift changes or if contractors are onsite. A designated person or position in an area such as the human resources department, security center, etc. should be responsible for accounting for all personnel and informing the coordinator of any persons believed missing. The task of accounting for the safe evacuation of all of your visitors will be more difficult, and will be dependant upon the size and nature of your facility.

Finally, media management is a consideration that should be addressed in your plan. While at Tidbinbilla we had the "good fortune" not to have to deal with the media in the weeks following the fires (they were preoccupied with the results of the disaster in the urban areas of Canberra), eventually they did start to understand the tremendous losses that had occurred in the rural and Reserve areas, and it became an issue which we had to deal with along with all of the other recovery responsibilities we had at the time. Many events that surround the death or injury of captive animals in zoological facilities can generate an enormous amount of media scrutiny, and the plan should identify who will act as the media spokesperson and provide a strategy for ensuring that the presence of the media does not detract from response and recovery efforts being undertaken.

Training and equipment.

Specific training and equipment may be required for employees who are responsible for rescue operations, first aid response and other specific crisis response situations as part of an emergency response team.

Emergency response teams are the first lines of defence in an emergency. Before assigning team

members though, consider whether the staff members are physically capable of performing any assigned tasks. Depending on the size and nature of your institution and its specific requirements and exposure to certain risks, several specialized teams may need to be trained, each of which should fully understand the potential emergencies they may be called upon to respond to and their containment. “Refresher” sessions must be regularly held to ensure that teams continue to remain familiar with response procedures, and to ensure that they are aware of any changes required to be made to the plan. Team leaders need to have the ability to give calm direction and personal leadership. They must know what to do, what their own responsibilities are, and who is in charge.

Specialized equipment may need to be used by emergency response teams, and all those involved should not only be thoroughly familiar in the use of the equipment, but trained to operate it in a manner which ensures not only their own safety but also the safety of those around them (the use of weapons is an obvious example here). The location of, and access to, specialized equipment needs to be considered – have duplicate sets stored in different locations to ensure that if one storage facility is lost in the emergency, you still have the required equipment in a separate location. Also ensure that regular maintenance and testing of the equipment is carried out so that you are not left facing a crisis situation with equipment that fails to operate.

As mentioned previously, consideration should be given to the purchase of key pieces of specialized equipment (such as generators or battery powered communication devices) to have onsite in an emergency event, as the rental of such equipment may be almost impossible to achieve if the disaster is more widespread than just your institution.

Finally, all staff in your institution need to be regularly trained in the procedures they should follow during a crisis event. In addition to providing formal sessions where people are “walked through” the plan and any areas of concern or confusion are explained to them, one of the best methods of ensuring that staff are aware of their roles is to perform regular drills and scenario exercises. The process of undertaking drills and scenario exercises not only confirms in peoples’ minds the mechanics and logistics of various situations that they may be faced in a crisis event, but these exercises are also crucial in identifying any weaknesses or inadequacies of your crisis management plan. After each drill or scenario exercise is completed, there should be a formal debriefing of all persons involved in the exercise where the feedback provided on any concerns or issues is then used to strengthen the plan.

A “desktop review” of the plan should also be undertaken on a regular basis (at least annually) and any changes or updates made and communicated to staff when required. While details such as ensuring that all changed escape routes, contact details and other matters should be updated as soon as these details change, the review of the plan on a regular basis will ensure that none of these items have been overlooked or omitted.

Putting your plan in writing or updating your existing plan and implementing actions outlined in the plan through regular reviews, drills and scenario exercises will ultimately reap benefits for your organization when a real disaster occurs. Remember also to invite your local emergency response organizations to tour your facility on a regular basis in order for them to become familiar with your facility and the plans that you have in place.

Recovery: A strategy for returning to “normality”

As people who live in communities that have been devastated by a crisis event will often say, there is no such thing as a complete recovery - disasters can forever change our ways of living. However there are ways in which your plan can outline strategies for minimizing the trauma and emotional upheaval that will no doubt affect those that have been involved. Post-incident measures include:

- Look after staff and others involved – ensure support for them
- Counseling – how soon?
- Debriefing – even in a minor crisis
- Prepare for industrial accident investigation
- Prepare for coronial or other legislative investigations
- Review procedural measures and refine if required

One of the things that occurs during a disaster situation is that many people find that their everyday reference points disappear or become obsolete given the changed circumstances and events that surround a crisis. While some people have an innate ability to adapt and quickly adjust to these changes, many will find it so unsettling that the security and confidence that they normally base their everyday life upon disappears, and so their ability to function and undertake normal tasks may be severely impaired. Until an individual faces a crisis situation, it is difficult to predict who will have the ability to rapidly adjust and cope with the changes, and for whom these changes will be much more difficult. Individuals have not only a varied response to crisis situations, but also have developed during the course of their lives different methods of coping physically and emotionally with the aftermath of a disaster. The main point here is to not treat all individuals who have been affected by a disaster in the same way, but to continue to treat them as the individuals they are.

One of the unfortunate decisions taken by senior management in the aftermath of the fires at Tidbinbilla was an attempt to exclude the wildlife care staff in the rescue and recovery phase of the emergency, as it was believed that it would be too traumatic for these individuals. However, it was soon made apparent to management that the wildlife care staff did indeed want to be involved as they were the people that were most familiar with the individual animals, their location within the various exhibits and their individual welfare requirements. While it was certainly not a pleasant experience for anybody involved when dealing with the removal of dead and critically injured wildlife, the utter sense of loss was tempered by the fact that they were doing something constructive rather than remaining at home, and that with every discovery of animals that had survived the fires their sense of hope for the future grew. More animals would have been lost in the post-fire emergency if the wildlife care staff had not been involved in the recovery process. In the aftermath of a disaster individuals may feel a sense of helplessness and a complete loss of control over the events in their lives, and for some individuals the need to return to work as soon as possible gives them some level of control in a situation where everything else seems to be out of control, and allows them to work through the events that have occurred. Again, rather than basing your decisions on the grounds that everyone will react to a disaster in the same way, treat them as individuals and allow them to have an input into decisions about how they want to be involved in recovery efforts.

One of the remarkable things that often happens during and after a disaster situation is that many of the rivalries and competition between individuals which may normally occur on an everyday basis becomes suppressed or completely disappears, and (for a short time at least) everyone involved works in a spirit of teamwork, cooperation and support for their fellow workmates. Many different emotions will surface in the aftermath of a disaster, however my experience has been that fellow colleagues will be the first to offer support and assistance to those who need it. Management can assist this process by understanding the physical and emotional changes that will occur during a disaster, and providing a supportive and caring environment for staff and others affected in its aftermath.

One process that can be used to facilitate and support the recovery of those involved in a disaster is through the provision of counseling to all those affected. By including everyone in the counseling session, individuals do not feel "singled out" or less adequate in attending the counseling session. However, during the course of counseling they may decide to seek additional counseling on an individual basis – again, this must be their own decision. When and how counseling will be made available to those affected will depend upon the type of disaster experienced, its severity and how quickly the emergency situation is stabilized.

At some point the recovery process will reach a stage where the threats from the disaster have been addressed, the response to it begins to wind down and there is some degree of a return to normalcy. At this point in time is when you should start planning for your next disaster! Debriefing of everyone involved (including external emergency response agencies) will be crucial to the future evaluation of your plan and what improvements and changes may need to be made to strengthen your plan. Debriefing should also occur no matter whether the crisis event you have experienced has happened on a major or minor scale. The longer the period between the disaster and when debriefing is

undertaken, the more people will forget as many people try to shut the trauma of the event out of their lives and return to the security and comfort of a normal life. Debriefing must be done in an open and honest atmosphere, and all comments and criticisms must remain within the debriefing forum – failure to commit to these principles will mean that important information will remain “bottled up” within individuals and the opportunity for any improvements to the plan will have been lost. The debriefing process in itself should be looked at in the light of allowing people to “get things off their chest” and whilst through this process some anger and other emotions may surface, it will be important for the recovery of individuals that their views are allowed to be expressed.

Later in the recovery phase you may be faced with an industrial accident investigation, coroner’s inquiry or other legislative investigation into the cause of the crisis and/or your response as an organization to the emergency. It will be imperative that any internal investigations undertaken look at the organizational response to the disaster, and does not become a “witch hunt” that simply seeks to find someone to blame.

Finally, having learned from the experience, having received feedback from all those involved in the emergency, and having received the findings of any external investigations and the like, it is time to review your crisis management plan and modify or refine those sections that are required, and communicate any changes to your staff and relevant external agencies. However, you should not wait until a disaster strikes before you review your plan, since for it to remain effective, this process should be done on a regular basis. Some of the most common weaknesses found in crisis management plans are:

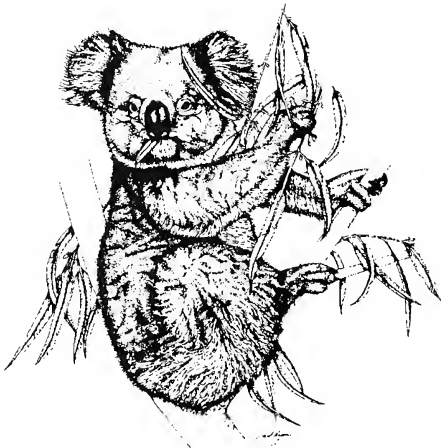
- No systematic collection of planning information. This includes such aspects as hazard analysis, organizational information, regulatory guidance, company policy procedures and location specific data.
- No systematic dissemination of planning information. You’ve assembled all the relevant information and have not shared it with the affected people - those whose responsibility it is to implement the plan!
- Failure to identify and establish a designated emergency response coordinator and a suitable incident command structure below this position. This is a common pitfall as many facilities try to fit their plan into a standard incident command system not designed around their particular needs.
- No, or minimal, coordination with affected entities. A lack of an effective communication process to alert staff, poor communications with the community, neighboring industries and external agencies (fire, police, hospitals, etc.) can lead to confusion and chaos during an emergency. A simple issue such as who is the primary contact for offsite agencies during an emergency can cause major disruption during an incident.
- Lack of (or poorly defined) organizational responsibilities. Failure to provide clear, concise procedures defining a person’s functions, duties and tasks upon assuming their emergency organization position.

- Once developed, the program is not (or is at best poorly) maintained and there is no provision for continued evaluation and periodic update of the material. Frequently, changed material, such as telephone numbers are buried in various paragraphs throughout the plan.
- The material you developed is not user-friendly. Your plan contains information - lots of it. Unfortunately, the user has to be a brain surgeon to figure out their role in its implementation. You did not provide simple, easy-to-use supplemental materials that can be used as a quick reference guide during an emergency. Worse yet, you didn't train anyone on the plan and their role in its implementation.
- You did not disseminate the plan to the proper authorities. Failure to include appropriate parties on the distribution list most often leads to failure on their part to respond in the manner you had hoped for.
- No senior management support or a lack of staff "buy-in". Unless everyone involved is seriously committed to the crisis management planning process, your plan will sit on a shelf gathering dust and will be useless when a crisis situation is faced.
- Lack of training and practice. A lack of familiarity and experience with the processes and operations that come into effect when an emergency situation is faced will only result in confusion and the discovery that critical equipment or other resources fail to operate.

The development of a crisis management plan will help to reduce the impact of a disaster upon your institution should you ever have to face such a situation. The plan should be based on the premise that you will anticipate the worst, but plan and prepare for the best possible results. If you believe that your facility will never face a disaster, then you are basically playing "Russian roulette" with all of the chambers loaded! Finally, I pray that you never have to use your crisis management plan.

Footnote: For advice or assistance in developing your crisis management plan, please feel free to contact me and I will be happy to assist.

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Disease Risk Communication and Highly Pathogenic Avian Influenza

By Robyn Barbiers, D.V.M.
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Before communicating any information concerning diseases, one must have a basic understanding of disease and the impact of disease. This paper can be viewed as a disease primer and will discuss general concepts of risk communication. After general concepts are introduced, a case study using a highly pathogenic avian influenza as an example will follow.

Disease outbreaks are inevitable. Potential pathogens are ubiquitous, and disease should be viewed as a normal part of an ecosystem. Disease is the result of the interactive relationship among the causative agent, animal, and environmental factors and can be depicted as the epidemiological triad (Fig. 1). Another way of thinking about these relationships is the "teeter-totter" metaphor (Fig 2). When the balance is tipped in favor of the animal, relative health is enjoyed. Many factors influence the relationship including gender, age, and immune status of the animal, weather, habitat, population density and prevalence of other diseases in the environment, and the virulence and dose of the agent.

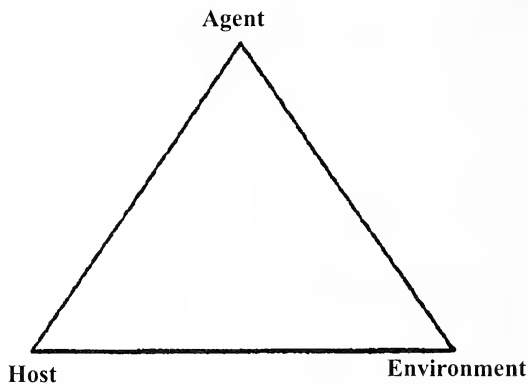


Fig. 1 - The Epidemiological Triad

Zoonotic diseases are diseases caused by infectious agents that can be transmitted between (or are shared by) animals and humans. Emerging diseases, as defined by the Centers for Disease Control and Prevention (CDC), are diseases of infectious origin whose incidence in humans has increased within the past two decades or threatens to increase in the near future. According to Woolhouse (2000), there are 1709 known pathogens. Eight hundred and thirty-two of those, or 49%, are zoonotic. And among the 156 diseases that are considered "emerging", 114 were zoonotic ¹.

Because we know that disease exists, institutions accredited by the Association of Zoos and Aquariums (AZA) have standards in place to minimize the risk of disease transmission. It is important to remember that zero risk is not possible.

Some of the AZA accreditation standards that are directly related to biosecurity include veterinary coverage available 24/7/365. The veterinary staff must be trained in zoonotic and foreign animal disease recognition. The veterinary program must emphasize disease prevention. All facilities must follow the guidelines for medical programs and zoo hospital standards written by the American Association of Zoo Veterinarians (AAZV) ². All incoming animals must be quarantined to reduce the risk of disease introduction and quarantine procedures are written in the accreditation standards. All animals must be observed daily by staff trained to recognize abnormal behavior and signs of

illness. Each facility must have established disease surveillance and containment procedures. All animals that die on zoo grounds must have a necropsy performed to look for evidence of disease processes. All accredited facilities must have adequate pest control practices in place. Cleaning and sanitation protocols must be written and followed to adequately prevent the spread of disease and help in prevention. Institutions must have written emergency plans that include a solid communication system.

Per the CDC, the most common mode of transmission of pathogens in humans is via the hands. There is substantial evidence that hand hygiene reduces the incidence of infections. This is an important point to emphasize to our public, volunteers, and staff when educating them about the risk of disease. AZA does have a policy addressing hand washing and other measures to reduce the risk of disease when the public has contact with the animals.

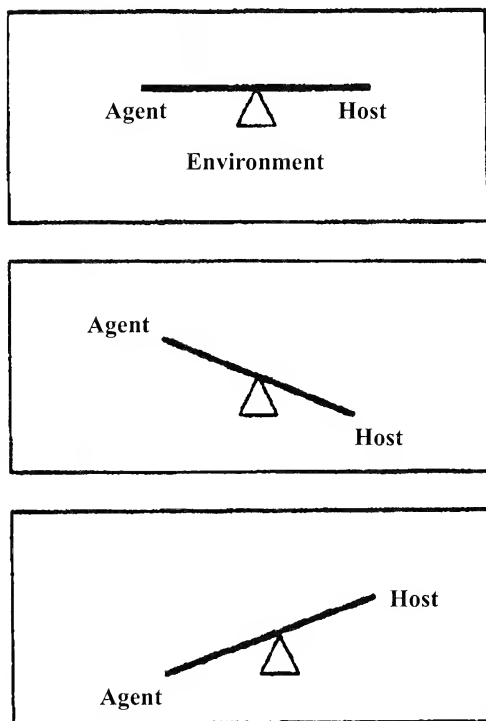


Fig. 2 - "Teeter-totter" depiction of the relationship

Some diseases have regulatory implications when they occur. These may involve regional or federal agricultural or public health agencies. Some examples:

- *Mycobacteria tuberculosis* in an animal is reportable to the Occupational Safety and Health Administration and public health officials.
- *Mycobacteria bovis* is reportable to the United States Department of Agriculture (USDA).
- Highly pathogenic avian influenza is reportable to USDA and public health agencies.

Other agencies may become involved during a disease outbreak depending on their missions and legal jurisdictions. Both the CDC and the Federal Drug Administration regulated the movement of prairie dogs after the monkey pox outbreak in 2003. The CDC has endorsed guidelines to prevent disease associated with animals in public settings after several outbreaks of *E. coli* 0157:H7 occurred

that were associated with animal contact. It is critical that each institution establish relationships with their regional and local public and animal health officials prior to an outbreak. It is important that these officials understand the unique needs of zoos. For example, in agriculture, test and cull is a routine method of disease eradication. Applying that strategy in a zoo setting would be detrimental to the endangered species zoos manage and may provoke a public outcry.

Disease may also have management implications. The presence of a disease may delay or prohibit the shipment/movement of animals between facilities or even within a facility, negatively impacting breeding programs. A positive serological titer does not mean the animal is capable of transmitting the disease, only that the animal has been exposed to the disease and has had an immune response. The North American Old World Monkey Taxon Advisory Group (TAG) has had difficulty managing captive populations because of positive foamy and simian immunodeficiency virus serology results, indicating that some animals have been exposed during their life, not necessarily that they are currently infected and can spread the disease. Individual zoos have refused shipment of a positive animal even though the receiving institutions had not screened their resident population. These refusals temporarily hindered the movement of animals per breeding recommendations, a frustrating situation for population managers. The TAG currently recommends that facilities know the viral status of their collection so informed decisions regarding transfers can be made.

We must remember that a communication plan and understanding of the consequences of the disease are essential **before** looking for diseases. Several years ago, testing reptiles for salmonella was controversial. Since salmonella can be intermittently shed in the feces, a negative test does not mean the animal is free of the bacteria. Treatment with antibiotics to eliminate *Salmonella* spp. has not been effective and treatment increases the risk of emergence of antimicrobial resistant strains. The current recommendations of the Association of Reptile and Amphibian Veterinarians and the CDC state that all reptiles should be considered to be non-clinical carriers of *Salmonella* spp. and appropriate precautions such as hand-washing, not giving reptiles access to food preparation areas, and not sharing food or drink with reptiles should be taken.

Many of the diagnostic tests used in zoological medicine have not been validated for the various exotic species. When using tests not validated for the specific species, the specificity and sensitivity are unknown. We can extrapolate from domestic and agricultural animal medicine, but we must be cognizant of the assumptions and the limitations for accurate interpretation.

The World Health Organization (WHO) states, "communication expertise has become as essential to outbreak control as epidemiological training and laboratory analysis" ⁷. As evidenced by the above discussion, communicating disease issues is a complicated task. One must be able to provide information to a lay audience on the etiology (cause), transmission, prevention, treatment and/or control and their impacts, testing and its limitations, morbidity and mortality rates and expectations. Often, we lack scientific evidence of the disease course in zoo species.

The WHO's Outbreak Communication Guidelines contain a shortlist of outbreak communication best practices that are summarized below:

1. **Trust.** "The overriding goal for outbreak communication is to communicate with the public in ways that build, maintain, or restore trust".
2. **Announcing early.** To minimize the surprise of partners when making a rapid announcement, a well-established communication pathway among key stakeholders prior to an event occurrence is essential. Since quick announcements are often based on incomplete or erroneous information, it is critical that the audience know that information may change and will be communicated to them.
3. **Transparency.** Communication that "is candid, easily understood, complete and factually accurate" is important.
4. **The public.** To effectively communicate, one must understand one's audience. "Risk communication is a dialogue."
5. **Planning.** "Risk communication is most effective when it is integrated with risk analysis and risk management. Risk communication should be incorporated into preparedness planning for major events and in all aspects of an outbreak response" ⁷.

There are numerous resources and literature available on risk communication. All of them discuss communication as part of preparedness. It is critical to develop relationships with public and animal health officials. If you are a veterinarian or animal manager, build a relationship and educate the person responsible for public relations at your institution. Encourage the development of a public relations template announcing a disease outbreak before the event and fill in the specifics when the event occurs. The template should contain the key messages you want to convey. Remember the STARCC principle in developing your public message ⁵:

Simple
Timely
Accurate
Relevant
Credible
Consistent

Staff should be trained in disease recognition and prevention. The key messages should be communicated to all staff and volunteers.

A spokesperson for the zoo should be identified and provided with media training. For those inexperienced in dealing with the media during difficult situations, practicing in front of a camera and reviewing and critiquing the tape can be helpful. Listed below are some key points to remember when dealing with any reporter. They may seem basic, but it's amazing how many times interviewees do not follow them.

- Listen to the question and think about your answer.
- Deliver and re-deliver your message.
- Only say what you know, not what you think, and don't speculate.
- Be honest. If you don't know an answer, say so.
- Do not state anything "off the record". Anything you say is public ⁶.

Case study – Avian Influenza

Avian influenza (AI) is not a new disease. Fowl plague, the best known disease caused by avian influenza virus was first described in 1878. Avian influenza, often called the bird flu, is an Orthomyxovirus virus that infects wild birds (such as ducks, gulls, and shorebirds) and domestic poultry (chickens, turkeys, ducks, and geese). The National Wildlife Health Center posts a list of species affected naturally and experimentally affected by H5N1 ⁹.

AI viruses are classified by a combination of two groups of proteins found on the surface of the virus; hemagglutinin proteins (H) and neuraminidase proteins (N). There are 16 H proteins (H1 – H16) and 9 N proteins (N1 – N9), so there are 144 possible combinations.

AI strains are further divided into two groups based on pathogenicity (the ability of the virus to produce disease):

Low pathogenicity avian influenza (LPAI) – these strains cause few clinical signs in infected birds and generally do not pose a health threat to humans. LPAI is monitored because the H5 and H7 strains have the potential of mutating into highly pathogenic forms. These strains are common throughout the world.

High pathogenicity avian influenza (HPAI) – these strains usually cause high morbidity and mortality in infected birds and are easily transmitted between susceptible species. HPAI has been detected and eradicated in U.S. domestic poultry three times in history (1924, 1983, and 2004). HPAI H5N1 is the strain that is currently of concern in S.E. Asia and other parts of the world.

The virus is transmitted by direct contact between healthy and infected birds through respiratory secretions and feces. Fomites such as contaminated equipment and materials can also spread the disease.

The symptoms, if any, of LPAI are mild and may include decreased food consumption, coughing, sneezing and a decrease in egg production. Signs of HPAI may include sudden death, lethargy, inappetance, decrease egg production, edema of the head, eyelids, comb, wattles, and hocks, purple discoloration of the wattles, combs, and legs, nasal discharge, coughing, sneezing, diarrhea, ataxia. Morbidity and mortality often reach 100% within days.

The WHO has a timeline for recent H5N1 avian influenza significant events. A brief overview follows:

1997 – First known human cases of H5N1 are reported in Hong Kong (18 cases, 6 fatal).

Dec. 2003 – Two tigers and two leopards die at a zoo in Thailand. H5N1 is confirmed in tissue samples. Animals were fed fresh chicken carcasses.†This is the first report of influenza causing morbidity and mortality in big†cats.

Feb. 2004 – In Viet Nam, an investigation of a family cluster of cases cannot rule out limited human-to-human transmission.

Sept. 2004 – Research shows that domestic cats experimentally infected with H5N1 develop severe disease and are infectious to other cats.

Oct 2004 – 147 tigers (out of population of 441) fed chicken carcasses at a zoo in Thailand die or are euthanized due to severe disease caused by H5N1.

Jan. 2005 –The first published account of probable secondary human transmission occurs in Thailand.

July 2005 – Captive palm civets died of H5N1.

March 2006 – Research helps explain why the H5N1 virus does not easily infect†humans. Avian viruses prefer to bind to molecules located deep in the lungs while human influenza viruses attach to molecules in cells lining†the nose and throat and are easily spread by coughing or sneezing. Findings are consistent with the clinical signs of human H5N1 infection†– lower respiratory tract disease with rapid progression to pneumonia ¹¹.

In 2005, the Animal Health Committee (AHC) of AZA, wrote *Avian Influenza: Guidelines for Prevention and Control in AZA Member Institutions*. Since every zoo has unique concerns, this document was intended to be used as a template to help zoo managers develop their own preventive measures. Planning and continuing dialogue with local, federal, and regional human and animal health regulatory agencies was emphasized. This document was posted on AZA's website and presentations were given at AZA's Directors meeting and other national and regional AZA meetings.

In early January, 2006, the AHC met with representatives from the CDC, USDA, and AAZV to discuss an emergency response plan in the event that HPAI was introduced to the U.S.: The outcome of the meeting was a document, *Highly Pathogenic Avian Influenza Emergency Guidelines for Zoos*. This document was officially submitted to USDA for consideration in developing the national plan. It was again stressed that each institution must develop its own strategies and that training and communication of the plan is essential.

An AI preparedness plan must include biosecurity measures during routine operations and during heightened risk. A response plan must be developed and may include vaccination as a tool to help containment or prevention. Animal, employee, and guest safety must all be considered in the plan. Each plan should discuss surveillance plans and communication and education about the overall plan. An incident reporting mechanism and response triggers must be outlined prior to an occurrence. Zoos have used different approaches in writing their individual plans: Lincoln Park Zoo (LPZ) used a decision tree model while the San Diego Zoo and Little Rock Zoo used alert levels based on WHO's pandemic flu alert phases.

During the January meeting, LPZ staff met with representatives from USDA, US Geographical Survey, AZA, and AAZV to develop a national surveillance plan for AI (*USDA APHIS Avian Influenza Surveillance Plan for Zoos, Exhibitors, and Aviaries*). The plan includes active surveillance by sampling collection waterfowl on open ponds on a monthly basis and passive surveillance by performing a necropsy on all birds that die on zoo grounds. This plan was funded by USDA and implemented in late 2006 or early 2007.

Several zoos outside the U.S. have vaccinated collection birds, and data on vaccine response is becoming available^{3,4}. In the U.S., vaccination of birds against avian influenza is strictly controlled by USDA Animal and Plant Health Inspection Service (APHIS) to protect the poultry industry and international trade. Approval to vaccinate any bird is needed from the USDA's Chief Veterinary Officer. APHIS has agreed to allow AZA accredited facilities to vaccinate endangered birds that are at risk with licensed and/or experimental AI vaccines. Zoos doing so must assume the off-label risk of using the vaccine in species other than those indicated on the label. AZA facilities may prophylactically vaccinate birds that are listed in the Convention of International Trade (CITES) Appendix I and/or in the U.S. Fish and Wildlife Service Endangered Species List. Zoos may obtain pre-approval to vaccinate birds listed in CITES Appendix II and III in the event that facility falls within a Surveillance Zone (outbreak in vicinity of the zoo). Vaccination of any mammal is prohibited at this time. There are a number of prerequisites for vaccination of birds including:

- Facility must have a written agreement to abide by standards described in the document (*USDA/APHIS Vaccination Plan for HPAI for AZA Zoos*), including participation in the national surveillance program.
- Each zoo must take measures to reduce the risk of transmission of AI from wild birds.
- State animal health authorities may conduct site inspections and review medical records.
- A list of birds to be vaccinated and individual bird identifications must be provided to the AI vaccine manufacturer.
- The Center for Veterinary Biologics (CVB) is the agency responsible for regulating the sale and distribution of veterinary vaccines. CVB will only authorize shipment of the minimum quantity of vaccine that will allow for the vaccination of the appropriate species at a pre-determined dosage for one year.
- Vaccinated birds will not be eligible for intrastate, interstate or international movement unless specific conditions are met and agreed to by state and/or federal animal health authorities¹⁰.

The shipment statement is significant. The cessation of movement of vaccinated birds may have a serious and negative impact on conservation programs. Each zoo must consider the risk of disease transmission and decide if the potential benefits of vaccination outweigh the risks involved. Zoos may decide to vaccinate prophylactically, vaccinate only when the risk of disease is greater, or take alternate measures, such as moving all birds indoors, to minimize the risk. There is no universal answer. Each facility must discuss its plans with the appropriate federal, regional, and local public and animal health officials prior to the introduction of this disease into the U.S.

AI is a complex disease and there are many unknowns. Since HPAI is of such high media interest, the public is aware of the existence and the potential threat. Providing information to your staff and volunteers on the basics of the disease and your preparedness is important. Writing a public communications plan with goals and key messages prior to any occurrence is recommended. A good communications plan should include strategies for disseminating the messages before, during and after the initial crisis. USDA has fact sheets and key messages for avian influenza with three scenarios (HPAI detection in U.S., HPAI H5N1 detection in wild birds, and HPAI detection in commercial poultry) available on their website, www.usda.gov. Communication to inform the public of the measures zoos are taking to help detect and prevent the introduction of the disease is also important. We need to let the public know of the biosecurity measures we take every day and of our plans to heighten those measures if the risk increases to assure them that zoos continue to be a safe

place to visit. Having press releases ready prior to needing them is another tool. AZA has generic press releases ready to personalize discussing preparedness and a FAQ sheet discussing avian influenza and zoos.

In the event that HPAI does become a reality in the U.S., appropriate precautions to prevent disease introduction and an inclusive response plan can only be effective in preventing public or staff panic if these measures have been comprehensively communicated in advance of the outbreak.

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Developing a Weapons Team for Dangerous Animal Emergencies: Organization and Training

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Introduction

Recently a zoo had a dangerous animal escape and a member of the zoo's emergency response team was forced to shoot and kill the animal when it threatened to attack one of the zoo staff. This tragic incident is not the first nor will it be the last where firearms have to be used to protect staff or public from imminent danger. In a survey on crisis management of institutions of the American Zoo and Aquarium Association, Baker et al. (1999) reported that over 16% of the reporting institutions had to discharge a firearm during a dangerous animal situation. If it unfortunately happens at your institution, you will be asked not only why you shot, but what training and experience qualified you to shoot, as well as what documentation you have to back up your statements. Previously, both Okimoto (1996) and Baker (1999) have provided excellent reviews of firearms and ammunition suitable for the range of dangerous animals found in zoos, but with little information on training. In this paper, we will provide a description of the training and organization of our weapons team at the Dallas Zoo, as well as our reasoning for the selection of firearms and ammunition.

Goals and Background

The primary goal of an emergency weapons team is to provide protection to staff and visitors from a dangerous animal attack by creating a well-trained emergency weapons team armed with suitable weapons. The emergency weapons team is introduced into a situation when judged necessary (i.e. the threat to human life is imminent). The goal of the emergency weapons team is to destroy the dangerous animal quickly and safely. This means killing, or at least incapacitating, the animal with the first round because to simply injure the animal would greatly aggravate the situation, possibly threatening more people including the weapons person. Speed is critical because the animal may already be engaged in an attack and the sight of the weapon by the animal may stimulate it further.

Safety is always a major concern in emergencies, but in a shooting situation it means minimizing the risk imposed to other humans during the firing of a weapon. In a situation where events happen very quickly and there are people in the area, before an emergency weapons team member fires a high powered rifle with lethal ammunition, that person must first consider the risk of ricochets and the risk of people being in the field of fire beyond the target. The shooter must always plan the shot so that the risk to other people in the area is minimized.

The Dallas Zoo's Emergency Weapons Team (EWT) was reorganized in 1999 after a gorilla escape (Kaemmerer, 2000). With the goals of precision, speed, and safety in mind, we began discussing and researching what would be required to achieve this. In an article on emergency weapons issues, Okimoto (1996) discussed many of the important considerations on which to focus. Safari hunting books (Mellon, 1975) and other big game hunting guides (Matunas, 1993) provided valuable information on weapons, ammunition, and aiming points. In addition, we discussed the issues with big game hunters, such as members of the Dallas Safari Club, who had actual experience in shooting many of the dangerous animals on our code red list (animals capable of causing death or serious injury if escaped from their enclosure). As a third source of information, we consulted with the major weapons and ammunition manufacturers (Federal Cartridge CompanyTM, Winchester, Inc.TM, and Remington Arms CompanyTM) to gather ballistics information on the weapons and ammunition that we were considering and to find out what was currently available. Finally, we reviewed all weapons and ammunition choices with an expert firearms panel composed of the Senior Firearms Examiner at the Ft. Worth Police Department Crime Lab; a Federal Bureau of Investigation weapons trainer; and

a Dallas Police Department Tactical Division sniper team member, trainer and a big game hunter in private life. For weapons care and training, we consulted with members of SWAT teams from local police departments. Because these units routinely train with high powered rifles and have well-established procedures for maintaining their own firearms, they were a good source of information on these issues. As a final source of information, we consulted with our own staff. Staff members with previous military experience in combat arms helped determine how the Emergency Weapons Team should be organized, trained, and deployed. In addition, our Senior Zoo Veterinarian, Dr. Thomas Alvarado, was very helpful in defining the location of critical organs in our dangerous species and where aiming points should be placed in order to destroy them. The advice of our Curator of Conservation Education and Science, Dr. Cynthia Bennett, was critical in determining the likely reaction of animals in stressful situations and what behavior characteristics weapons team members need to watch for.

Weapons, Ammunition, and Aiming Points

Based on the information we obtained during our research, we decided on three basic weapons to cover the range of dangerous animals in our collection: .458 Winchester, .375 H&H, and .45-70 Marlin with lever action. We chose weapons based on four criteria: 1) large enough caliber to effectively penetrate the skull of the animal for which it would be used; 2) features that enhance the accuracy, ease of operation, and safety of the weapon; 3) readily available from manufacturer at a reasonable price; and 4) readily available ammunition of the type we need for each weapon type. For rifles, we use only bolt action or lever action weapons, which are less likely to jam and are less expensive. For several years we utilized .30-06 Springfield rifles, and 12-gauge shotguns, but we discontinued them on the advice of the expert firearms panel noted above. We purchased the .45-70 Marlins (Model 1895 Cowboy - 9 round magazine, 26" barrel), which were thought to be a better weapon for support to the larger rifles or for use on smaller dangerous animals. In addition, we have mounted wide-field scopes on all our .375 and .458 caliber rifles. Although most engagements would probably take place at a fairly short range (under 50 yards), we have found that the use of a scope still greatly improves the accuracy of the shooter. Wide field scopes make it easier for the shooter to quickly locate the target.

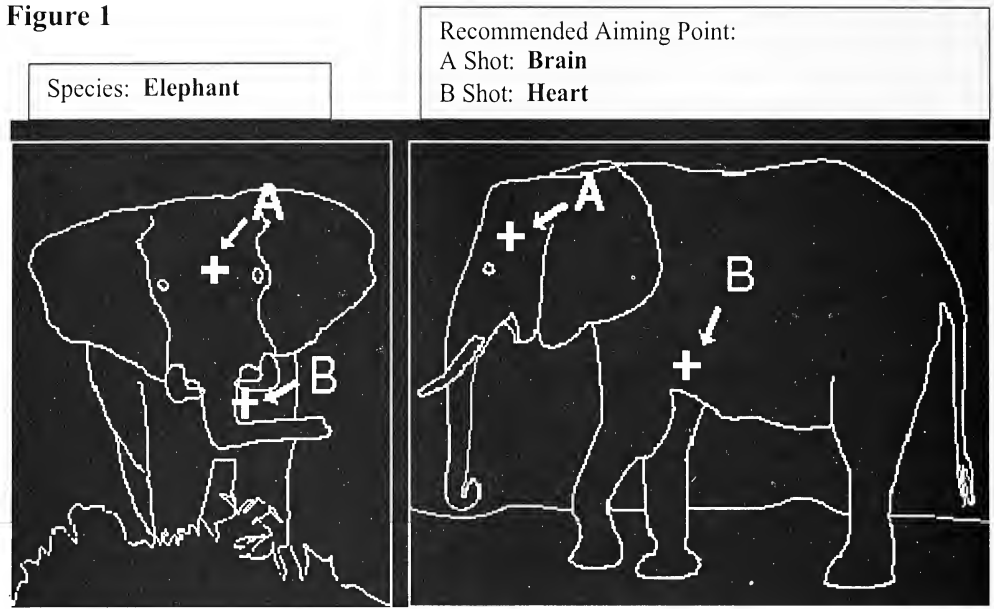
We use the .458 with solid ammunition for large mammals such as elephant, rhinoceros, hippopotamus, and forest buffalo. We have opted for the larger caliber over the .375 H&H to ensure that a shooter can stop a large mammal with one shot even if the round does not exactly hit the optimum entry point on the skull. The risk we take with the more powerful rifle and ammunition is that the round may exit the animal and continue on beyond the animal. To compensate for this risk, we teach our shooters to always try to pick a firing position where they are shooting down at the animal (so the round will ground quickly if it exits the animal or the shooter misses) or at least have a solid background behind the animal such as an earth bank or a thick stone wall.

For medium-sized animals such as tigers, lions, leopards, gorillas, and chimpanzees we use the .375 H&H with a softpoint, mushrooming head type bullet. For smaller animals such as mandrills or caracals, we use the .45-70 Marlin rifle with Bonded core 350 grain ammunition. The caliber selected has enough power to ensure penetration of the skull on these animals, but the softpoint bullet reduces the risk of the bullet exiting the animal.

We also still maintain 12-gauge shotguns in our gun cabinets with .00 buckshot ammunition for use if necessary for cassowary and ostrich because the critical organs are a difficult target for anything else.

We chose aiming points with the objective of destroying a major organ in the animal to ensure a first round kill and a chance of immediately stopping an attacking animal (Figure 1). Beyond this, we have two criteria for choosing aiming points, based on the situation that the shooter is in. If the shooter is able to get a good supported firing position and is able to take a well-aimed shot, then the shooter aims for a penetration point that will destroy the animal's brain identified as an "A Shot", which ensures an instant kill. If the shooter is not able to get a good supported firing position or does not have time to take a well-aimed shot, then the shooter aims for what we identify as a "B Shot". This is a "center of mass" shot with the objective of destroying the heart or the lungs of the animal. Even though it may not ensure an instant kill, it will at least enter the torso of the animal and hopefully cause enough damage to temporarily incapacitate the animal.

Figure 1



Recommended Weapon:

1st Choice: .458 Winchester

2nd Choice: .375 H & H

Recommended Ammunition:

1st Choice(for .458): Federal Premium Safari Rifle cartridge w/ Trophy Bonded Sledgehammer bullet, .458 Win Mag., 500 grain

1st Choice(for .375): Federal Premium Safari Rifle cartridge w/ Trophy Bonded Sledgehammer bullet, .375 H&H Mag., 300 grain

Caution:

These rounds have tremendous penetrating capability and tremendous range so always be aware of what is behind the target animal. If possible, try to pick an elevated firing point (i.e. rooftop) so that the round will go into the ground after it exits the animal or if it misses the animal.

Key Behavior & Capabilities:

Very good eyesight & hearing. Very quick & agile. Can be very aggressive. Easily startled. Is intelligent & learns from previous experiences. Size & mass makes this a very dangerous animal. Will use head to crush.

Indicators of Threat Display:

Ears out, head up, trumpeting, roaring. Will do "demonstration charge": generally shaking head, squealing angrily with trunk raised, and flapping ears. In this charge the animal is bluffing and will probably veer off.

Indicators of Intent to Injure or Kill:

Charge is very intent & forward, elephant comes quietly and at full speed, trunk lowered, & ears pressed tight against head.

Response to Weapon being Pointed at Animal:

Reaction is not clear. May not give attention to it or may get aggressive. If confronted by an elephant and unable to fire, your best defense is to run and climb or try to put a large object between the animal and you. If you fall or are knocked to the ground, roll away from the animal. Try to roll towards a safer position such as a moat, under a log, or towards a fence. Try to keep moving.

Figure 1: Example of Emergency Weapons Team Reference Card. There are cards for each of the eight designated "dangerous animals" at the Dallas Zoo (gorilla, chimpanzee, male mandrill, elephant, rhinoceros, lion, tiger, cheetah).

Organization of the Emergency Weapons Team

The organization of the emergency weapons team supports unified leadership capable of decisive action but accountable to the zoo management. Qualified assistants to the leader are also included who are able to focus on key issues that prepare the team for operation and provide backup leadership if the EWT leader is unavailable. The shoot team structure provides for flexibility, safety, and speedy deployment.

EWT members at the Dallas Zoo can come from all levels and departments of the zoo. It is strictly voluntary, but members must have the approval of their supervisors and the EWT Leader, be medically and physically fit, and must have worked at the zoo for at least one year. They must be able to attend the required and scheduled training classes and firing sessions to qualify on a weapon. Fortunately, we received approval from city officials to provide members with a small monthly incentive stipend, as long as they maintain their qualifications. Generally, we have from 12-17 EWT members for a zoo of 250 employees, but this is also now augmented with trained Dallas Police Department patrol and tactical officers who are trained on the two largest caliber rifles.

The Dallas Zoo Emergency Weapons Team is organized with one EWT leader who has overall responsibility for decision making and management of the EWT. He develops policy and protocol for the EWT, answers to and coordinates with senior zoo management for their actions, and serves as liaison with the Dallas Police Department (DPD) for operation, coordination and training. During a dangerous animal emergency he also functions as the tactical leader of the EWT and advises the Emergency Response Team (ERT) leader or Incident Commander (for a description of this coordination and procedures during a dangerous animal emergency, see Kaemmerer and Piwonka, this volume). The EWT leader is assisted by a training officer, a safety officer, and an armorer.

The training officer plans and coordinates the training of the weapons team. This individual may call upon certain members with suitable skills or outside experts to conduct the training, but is responsible for scheduling the facilities, lining up resources, and ensuring that the EWT members are informed of the training schedule. Along with the EWT leader, the training officer also monitors the quality of the training and keeps the attendance records. In the absence of the actual EWT Leader, the training officer assumes command as the acting EWT leader.

The duty of the safety officer is to ensure that all training is conducted as safely as possible by observing for unsafe acts. S/he also teaches the weapons safety classes.

The armorer is primarily a support person, who ensures that all the weapons, ammunition, and other related paraphernalia are available and functional. The armorer conducts periodic inventories of the gun cabinets to ensure they are correctly stocked and purchases ammunition and other items as needed to restock the gun cabinets or for training. This individual also checks the cleaning and maintenance of the weapons and coordinates repairs. The cleaning of individual weapons is the responsibility of the EWT member who is assigned to that weapon, but the armorer ensures that this action happens and is performed correctly. The armorer also coordinates an annual safety inspection by a licensed gunsmith on each weapon. The armorer also conducts the weapons cleaning and maintenance training for the weapons team.

All members of the EWT are organized into shooting pairs (in an actual emergency, the training officer, safety officer, and armorer can also function as members of a shooting pair). A shooting pair consists of a lead shooter and a support shooter. The lead shooter is generally equipped with a high caliber rifle and the support shooter with a .45-70 Marlin rifle, but this may change depending on the species involved. At the Dallas Zoo, we produce a schedule of assigned emergency personnel for each day. For the weapons team, we strive to schedule an EWT Leader (the actual EWT Leader or one of the assistants) and three shooting pairs. Having a leader and three shooting pairs available provides adequate flexibility for any emergency. If we have less than two pairs scheduled, we will pay overtime for EWT members to work to ensure a minimum of two pairs.

Deployment of the Emergency Weapons Team During a Dangerous Animal Emergency

At the Dallas Zoo, the EWT responds to situations where a dangerous animal has escaped its enclosure and to situations where a human is in an enclosure with a dangerous animal. When the emergency is

announced, the EWT Leader proceeds directly to the Command Post (see Kaemmerer and Piwonka, this volume). All other members of the EWT on that day's schedule proceed to the appropriate gun cabinet (where their assigned weapon is located) and get their assigned weapon in a gun case, an orange vest, a master key ring, EWT reference cards (Figure 1), and reserve ammunition. They then proceed to the staging area establishing radio contact with the EWT Leader while enroute.

After arriving at the Command Post, the EWT Leader remains with the Emergency Response Team (ERT) Leader and/or Incident Commander throughout the emergency to advise in deployment of the EWT and help provide command and control of the EWT. As the EWT members arrive at the staging area, they are paired with their shooting partner and deployed as part of a task force. The task force is a mixed-resource team configured for whatever mission it is given. If the task force is to rescue an injured individual, then it may consist of a leader, a Dallas Fire-Rescue paramedics team, and an EWT shooting pair for protection. If the task force is to search for and recapture the escaped animal, then it may consist of a leader, a veterinary dart team, and a two to three member EWT shoot team. The task force may also include or be led by patrol or SWAT officers from the Dallas Police Department, who have received animal behavior training provided by the zoo and are equipped with high caliber rifles. The task forces are assigned their mission by and deployed on command of the ERT Leader/Incident Commander. If the situation requires, the EWT Leader or ERT Leader may also direct the EWT shooting pairs by radio to specific sites while they are enroute to the staging area. All EWT communication is conducted on the main zoo emergency radio channel to ensure that everyone is aware of their locations

When the shooting pairs deploy, the partners stay within ten yards of each other so that they can cover each other. For most situations, the lead and support shooter stay abreast of each other to minimize the chance of either one getting in the field of fire of the other. The support shooter conducts all radio communications so the lead shooter can keep both hands on her/his rifle. The main function of the support shooter is to back up the lead shooter. If it becomes necessary to fire on a dangerous animal, the lead shooter will quickly assume a suitable firing position, always seeking a supported position when available. The support shooter will also assume a firing position, but maintains a good view of the area around the lead shooter. If the lead shooter fires on the animal and misses or fails to incapacitate the animal, then the support shooter will engage the animal using the rapid fire capability of the Marlin rifle to attempt to stop or slow the animal's attack as both members move back to a protected position. This allows the lead shooter to set up for a second shot, or another EWT shooting pair to engage the animal. At the Dallas Zoo, the EWT shooting pairs will not normally fire unless given the authorization to do so by the ERT Leader or Incident Commander. They are allowed to shoot without authorization only if they feel that a human life is in immediate danger.

Training of the Emergency Weapons Team

Training consists of marksmanship training, practice shooting on ranges, periodic classroom training on subjects critical to the EWT, and periodic drills conducted for all ERT members. Shooting practice is conducted at ranges on a monthly basis to ensure that each EWT member maintains his or her skills at an acceptable level. EWT members are required to qualify on their assigned weapon and familiarize on a 12-gauge shotgun semiannually, attend at least two of the practice ranges during each six-month period, and attend all mandatory classroom training. These are the minimum requirements, but EWT members are encouraged to attend as many practice ranges as possible to improve their shooting skills. All EWT members are also encouraged to cross-train and qualify on more than one weapon to provide more flexibility during an emergency. Since 2003, training has been enhanced by collaboration with the Dallas Police Department Tactical Division.

Normally, two sessions for weapons qualification and four practice sessions are conducted at a range every six months. Shooting practice is conducted primarily on a local Dallas Police Department (DPD) range with both static and moving targets and adequate range space to exercise movement and communication between shooting pairs while shooting. If that range is not available, then the training is conducted on a local public range with static targets. Instruction on the DPD range is provided by SWAT officers. If using public ranges, instruction is provided by the EWT Leader and the most experienced EWT members. Practice shooting always begins with a brief overview of the range operations for that day along with safety reminders. Time is then allowed for the zeroing of rifles as necessary. The shooting pairs will then be exercised in various shooting drills, including: moving

down a maneuver lane and engaging targets on command to exercise coordination and communication between team members; engaging targets in quick-fire; engaging moving targets; switching between scopes and iron sights; engaging targets from elevated positions at long distance; deploying from vehicles and engaging targets; engaging targets through obstacles; and others as devised to exercise particular skills. For the purpose of safety, a range officer is assigned for each range. This individual controls the movement on and off the range, checks the chamber of each weapon at the end of each firing order to verify that each weapon is clear before allowing anyone to go down range to check targets, and watches for unsafe acts on the firing line. Safety officers are always provided on each shooting range. If the exercise involves moving while shooting, then a safety officer follows behind each shooting pair. In addition to actual shooting drills, various non-shooting drills are also incorporated into the training to exercise movement of teams searching through wooded areas or through buildings or negotiating an obstacle course with various fence structures.

When a zoo staff member is accepted for initial training with the EWT, they must complete at least two of the practice ranges and achieve a qualifying score within six months. Prior to being placed on the firing line during the first practice range, new members receive basic marksmanship training from either the EWT Leader or the Training Officer. The basic marksmanship training consists of operation of the weapons, steady hold techniques, aiming techniques, shooting positions used by the EWT and how to assume them, weapons safety, and range operations. Once the new members complete the basic marksmanship training, they are placed with an experienced EWT member or a DPD SWAT officer to act as their coach on the firing line.

After an EWT member is assigned a new weapon, s/he verifies the zero of the rifle during the next shooting practice. The purpose of verifying the zero of the rifle is to ensure that the rifle sights are adjusted to the shooter so that the bullet strike is the same as the point of aim on a target at 50 yards. The zero is verified/adjusted from a benchrest or prone firing position by firing a minimum of three rounds at the center point of a target at 50 yards. If the strike of the rounds on the target are within one inch of each other, and the shot group is centered on the center point of the target, then the rifle is considered zeroed for that shooter. If the strike of the rounds on the target are not centered on the center point of the target, then the sights for the rifle are adjusted to bring the shot group to the center of the target. Once a rifle is zeroed, then the EWT member assigned to that rifle is the only person allowed to adjust the sights of that rifle. If another EWT member cross-trains on that rifle, they must use the zero of the shooter assigned to that rifle.

In addition to the practice range training, all EWT members also attend periodic classroom training on subjects that are critical to the proficiency of the EWT members. The classroom training is normally mandatory, but each session is conducted twice a month, so EWT members have at least two opportunities to attend the training on each subject. This helps to avoid pulling all EWT members away from their normal duties at the same time. Classroom training is conducted by an EWT member with particular expertise in the subject, by a zoo staff member (e.g. a zoologist explaining behavior of a dangerous animal), or by an outside subject matter expert (e.g. a professional weapons trainer, police department trainer). Subjects that are taught during classroom training may include the following: safety issues; types, safe handling, and storage of ammunition; care, cleaning, and maintenance of weapons; behavior of dangerous animals; anatomy of dangerous animals; EWT Reference Cards; Dallas Zoo Emergency Procedures Manual; EWT deployment techniques; EWT communications; and selecting observation and shooting positions.

Qualification Standards

We have developed qualification standards for the Emergency Weapons Team members at the Dallas Zoo in order to have consistent standards to check the quality of our training and to determine when individual EWT members have developed their skills sufficiently to allow them to function as a member of the EWT during an emergency. These qualifications are reviewed every six months and EWT members who fail to maintain their qualifications are taken off the emergency response team schedule. Moreover, qualification standards and records for each EWT member provide documentation of training, which can be important should there be questions from any outside source (legal, media, etc.). Because we could not locate standards from other professions who face the same shooting situations that zoos face, we developed our own standards. The qualification standards should cover both shooting and non-shooting training. We developed specific shooting qualification standards, but our non-shooting

training standards consist only of attendance at trainings. We plan to develop evaluations for non-shooting training in the future.

Our qualification standard for rifle shooters requires firing nine rounds at a silhouette target at 25 and 50 yards. Three rounds are fired from an unsupported standing position at 25 yards and six rounds from any unsupported position (standing, kneeling, or prone) from 50 yards. All nine rounds must impact in the center region of the target. We use the same silhouette target as the Dallas Police Department since it is a recognized standard.

We use the unsupported standing, kneeling, and prone firing positions because these are the three most likely firing positions that an EWT shooter will be able to quickly assume. We always train our shooters to seek a supported firing position so that their shooting will be more accurate, but we evaluate based on unsupported positions since these represent the worst case scenarios. We choose to evaluate our shooters at 50 yards (and also zero our rifles at 50 yards) because this is probably the farthest distance that our shooters will ever be able to engage an animal in an emergency situation due to the uneven terrain at the Dallas Zoo.

In addition to the rifle qualification, each EWT member is required to familiarize on a 12-gauge shotgun every six months, so they will be able to use that weapon if an emergency involves an ostrich or a cassowary.

Documentation

Documentation of all EWT training and activities is very important to evaluate the quality of the training provided and the progress of individual members. Documentation is also vital for legal purposes. If a death or injury results during an emergency situation, the qualifications of the emergency weapons team could be questioned in court and may require proof of the quality of the training, the shooting qualifications of individual team members, and the maintenance standards on the weapons. Our local police department and city legal department have advised us that these records must be maintained for a period of ten years.

At the Dallas Zoo we record the qualifying score of each EWT member, the date they fired, and the serial number of the weapon they used. In addition we archive the actual target that the qualification was fired on. Attendance records are kept of all EWT training sessions. These qualification records are evaluated semiannually by the EWT Leader, who maintains a list of all shooters qualified on each weapon type. This list is used in scheduling EWT members as part of the emergency response team each day. All of these records are maintained in a spreadsheet which provides for easy summarization and analysis of data so that the progression of training of each member can be easily evaluated.

We also keep a number of non-qualification records. We keep inventory records for our weapons, ammunition, and other items that we are required to keep in the gun cabinets. All of our ammunition is dated at the time of purchase so that we can keep track of the age of the ammunition in our gun cabinets. We normally rotate out the ready ammunition on the weapons and the reserve ammunition in the gun cabinets after one year to ensure the quality of the ammunition available for use during an emergency. The old ammunition gets used during shooting practice. In addition to inventory records, we keep records on the number of rounds fired at practice by ammunition type (for inventory control and also to project ammunition needs for the next year), as well as the total number of rounds fired by each weapon, which is important if we ever have to prove the quality of an individual weapon in court.

Also, as mentioned earlier, we maintain a maintenance log on each weapon. This log is maintained by the EWT member assigned to the weapon and is kept with the weapon in the gun cabinets. On this log, the EWT member notes the number of rounds fired after each range practice, the date of each cleaning and any problem noted with the weapon. The EWT member signs each recording on the log (this is another record that we were advised to keep for legal purposes). The EWT armorer reviews the maintenance logs each month to ensure that all weapons are being cleaned regularly, as well as confirming cleaning through spot inspections. He notes any problems recorded so that repairs can be arranged. The EWT Leader also reviews the maintenance log of each weapon once a quarter and signs each log to verify that the records are being properly maintained.

Conclusion

The training of an effective emergency weapons team to respond appropriately to a dangerous animal emergency is a very time and resource consuming job. However, unless there is an agreement with outside enforcement or security forces to handle weapons for dangerous animal emergencies, it is a necessary adjunct to complete a zoo's emergency procedures. Even though smaller zoos may not have as many resources as larger zoos, the principles are the same. Thoroughly review your institution's procedures and equipment for the weapons team, the team's composition, and the team's training and documentation to ensure that they can meet the challenge of a real animal emergency.

Acknowledgements

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Products and Manufacturers Mentioned

Federal Cartridge Company(tm), Anoka, Minnesota 55303, www.federalcartridge.com

Remington Arms Company(tm), Lonoke, Arkansas, www.remington.com

Olin Brass and Winchester Inc(tm), 427 North Shamrock Street, East Alton, IL 62024, (618)-258-3507

Winchester Firearms(tm), U.S. Repedic Arms, 1-800-945-1392, www.winchester-guns.com

Who's Afraid of the Big Bad Wolf?

Dealing with a long-term, high-profile animal escape

By Jennifer Barnett, Director of Wildlife Management
Binder Park Zoo, Battle Creek, MI

It is something you read about all the time, a large animal escapes from a zoo causing panic and destruction. What a nightmare that would be and you hope it never happens to your facility. We run our escape drills and trainings on a regular basis without fail. We even have actual animals escape every so often. A wallaby hops over the fence or a vulture gets through the hot wire of its enclosure and wanders away. We have always dealt very well with these situations. When a red panda (*Ailurus fulgens*) escaped and made it about 20 yards from our perimeter fence, and then climbed 40 feet up a tree, we were able to quickly recapture the animal. Even when a pinioned stork managed to catch a strong wind and glide about five miles away, we managed to get him back with out incident the same day. However, none of this had prepared us for what was to come.

On Sunday, 3 January 2004, at approximately 0815hrs, the animal care staff headed out to work after their morning meeting. They noticed two large animals at a distance moving west down the tram road just behind the zoo office. At first they assumed what they saw were coyotes. Just to be sure, a keeper ran to the Mexican wolf (*Canis lupus baileyi*) exhibit just a couple hundred yards away to check on our wolves. Their worst fears were confirmed when they discovered only three of the six male wolves were in the enclosure. Staff immediately locked the three remaining wolves down in a back holding area and went to check the exhibit. Others began to track the animals they had seen earlier. It was a holiday weekend and nine animal care staff members were the only staff on grounds. The supervisor on duty immediately went to call the curator and then went back out to lead the search effort. The curator in turn called her supervisor, and then began calling in all available staff from education to housekeeping to maintenance. By 0900hrs all senior animal care staff had reported in, the President and CEO had been notified, and a plan was underway to recapture the wolves.



Three members of the Binder Park Zoo Mexican wolf pack. (Photo by Melissa Ashley)

The Mexican wolves had escaped through a 10-inch diameter hole they managed to pull open in the heavy nine-gauge chain link fence that enclosed the exhibit. They had chewed on the fence during the night and managed to break only one wire. This allowed them to pull the fence apart enough to squeeze out. We have kept wolves, including timber wolves (*Canis lupus*), in this same exhibit for over 17 years without any problems. Why, all of a sudden, did they want out so badly? They wanted out badly enough that they had to squeeze very hard to fit through that hole, leaving plenty of fur behind. The wolves had been restless the last few days and this was peak breeding season, but there were no female wolves for hundreds of miles. Perhaps this was the problem. Maybe they were looking to start a new pack or find new territory. The pack consisted of five brothers

and their sire. There had been some dominance struggles, but the sire was still the alpha male based on our daily observations.

We were fairly confident that our nine-foot perimeter fence would keep them inside the park as long as they were not pushed too much. Within an hour, two of the wolves were located on the southeast side of the park in an empty ten-acre field. The third wolf had last been sighted on the west side of the zoo in a heavily forested area before staff lost sight of him. We decided to concentrate on the two wolves we now had in the field, and left one staff member with a radio to monitor the area where the third wolf had been last seen. About 40 staff members were on grounds by then and the

plan was to confine the wolves in the field using staff as a human barrier. We would then send someone on the outside of the perimeter to try and dart them through the fence to sedate them. We also considered hand catching them as this is how we normally handle them on exhibit. If the capture attempts failed or pushed the wolves too much, we would move our line back and allow them back into the park and re-think the plan.

Our first line formed about 300 yards away from the wolves. They were tense and agitated and began running up and down the far south perimeter of the field. The first male calmed down and did lie down and cower, but the second wolf, Apache, grew more agitated and nervous and began jumping at the fence. We immediately began to back up our line to give him more space and calm him down. As the line moved slowly back, Apache jumped up in a corner section of the fence and easily propelled himself up and over and out of the park. He ran out onto the very wooded and large golf course that ran along our south perimeter. Staff quickly opened up a large hole in the line allowing the wolf who had been cowering to run back into the park. Two keepers went out onto the golf course hoping to keep the wolf in sight, but in hindsight they probably helped drive him further away. Apache ran full speed due south across the golf course, crossed a main road and disappeared into several wooded acres. It was obvious that he was looking to get far away!

The situation was looking really grim, but we still had hopes that Apache would come back to his familiar territory and pack once he calmed down. We called the President and CEO, the local police and the golf course staff to let them know what had happened. We also called the local Department of Natural Resources and the U.S. Fish and Wildlife Service, but left only messages since it was almost impossible to reach these agencies on the weekend. We decided at this point it would be best not to alert the media or the neighbors. Mexican wolves are not a threat to people or to most other animals. The police said, "No problem, let us know if we can help." They never sent any officers or even questioned us, and this was due in part to our on-going effort to keep them informed, educated and aware of our training and expertise. They trusted our judgement.

We left a gate open in the perimeter fence near the spot where Apache had escaped and baited it with food and feces from other pack members, hoping to entice him back. We also left a zookeeper who works with the wolves on a regular basis to monitor the fence and grounds. The last thing we wanted was something else walking through the gate either into or out of the zoo! The rest of us focused on capturing the remaining two wolves. We ended up cutting the fence and creating a funnel into the wolf exhibit. Using all the staff and volunteers we could get, we formed a long line across 2000 feet of the park and pushed the wolves through the wetlands and woods and right back into their exhibit. That was the easy part.

We regrouped, very quickly grabbed some food and set up a plan to get Apache back. We were confident that he would want to return to his pack and that he would stay near the zoo. We set bait piles of food up all around our four-mile-long perimeter fence and also set several large live traps. Staff monitored the area until dark with no sign of Apache. It was decided that there was not much we could do in the dark. The area was very remote and temperatures were expected to drop below zero.

It was very difficult going home that night and I am sure no one got much sleep. Little did we know that this day would turn into a two-month-long ordeal that would include sleepless nights, too much exercise and a persistent nagging stress that still plagues us to this day.

On Monday, the next day, we came in before dawn. General Curator Andi Kornak and I did not work regular areas so we would be the main trackers, using the Animal Care Supervisors for back-up. Again, we did not expect this to go on for more than a day or two. We immediately checked the traps and all the baited areas along the fence. It had snowed overnight so any tracks would be easy to see. We did find one set of tracks leading in from the south. Apache had returned during the night and had run along the perimeter for several hundred yards, but did not touch any of the bait piles. He then headed back south towards the woods. We began searching the woods and marshes by foot and on skis, hoping to find evidence of where he had slept. The wind was blowing and the tracks disappeared and we found nothing.

By Tuesday morning, with no further trace of Apache, we knew we needed help and that we needed to go public. Greg Geise, our CEO, wrote a press release that was sent to the media in our area and surrounding counties. Not only did we explain exactly what happened, but we also asked for help from the public. We set up a voicemail box for wolf reports and asked them to call with any information or sightings. We braced ourselves for the onslaught of blame and fear from the public, and we worried about the local hunters and trappers who may want to get their "hands on a wolf".

The zoo is located in a very rural area. There are thousands of acres of farmland, woods and wetlands surrounding the zoo on three sides. The wolf could travel all the way to the Indiana border through this country without much difficulty. On the west side, a housing development was built on an old farm field several years back, and there are hundreds of new homes with lots of children and pets. We immediately started receiving tips from people in the area. Almost everyone who called was supportive and concerned for the safety of the wolf. No more than one out of a hundred calls was negative, and usually their concerns were greatly diminished after we talked to them. In fact, a few of them became great supporters of the wolf and the Zoo. The press was also very kind to us, and we felt they gave the wolf story positive coverage. The few negatives comments came from one individual columnist who thought he was being funny. He did end up printing something that resembled an apology after he received hundreds of letters from Zoo supporters complaining about his column and his attitude.

Thus began our days of coming in before dawn, checking the perimeter fence and then checking on every wolf call or sighting that came in. When we talked to the USFWS, who actually own the wolves, they told us that we were not authorized to touch the wolf outside of our perimeter. They agreed to send a couple of wolf trappers from USDA Wildlife Services in the Upper Peninsula down to trap the wolf. We continued to search from sun up to sun down every day. The temperatures remained in the single digits during the day and dropped below zero at night. The weather was not an issue for Apache as much as it was for staff. He was well-adapted to the cold Michigan winters. Our greatest concerns were that he would be shot, caught in a coyote trap, or hit by a car.

On 7 January, four days after the escape, two very experienced wolf trappers with the USDA Wildlife Services came down to help track and capture Apache. They were confident that they could get him easily since he had lived in captivity all his life. We discussed a plan of action and decided that an air search would be helpful in pinpointing his location. We hoped that he was still in the area, as we had seen tracks near the west perimeter that same morning. He had even helped himself to some dog food stored outside a local garage that night. Our CEO contacted State Senator Mark Schauer who offered the use of the Michigan State Police Helicopter that was equipped with thermal imaging. For two days they flew us directly over the zoo and over the four surrounding counties. Two searchers were in the helicopter with the pilot, and four to six chase vehicles were on the ground to respond to any sightings from the air. We checked out several possible sightings, but they all turned out to be dogs or coyote. The coyote proved to be a big problem. The wolf just happened to escape during prime coyote breeding season. More than 90% of the sightings we received proved to be coyote, but we checked every one just to be sure.

As our expertise in tracking increased so did our anxiety about ever getting Apache back alive. The Wildlife Service trackers brought down some "howling" equipment - a large amplifier and a CD of wild wolves howling. They drove around the area and played the howling CD very loud hoping to get a response from Apache. We also played a CD of howling to our pack to get them howling in hopes of calling Apache back home. We heard distant howls a few times in return, but it never seemed to bring Apache closer. After a week of finding only a few tracks, the trackers had to return to their work in the U. P. They left with a promise that if we found the wolf, they would get back as soon as possible to trap him. In the meantime, we were working with the USFWS to obtain a permit that would allow us to capture the wolf ourselves.

We continued our daily vigil of walking the entire perimeter, the surrounding neighborhood, fields and woods. We traveled to check possible sightings or tracks as far as 40 miles away. We received as many as 30 calls a day with tips about the possible location of the wolf. Late on the evening of 19 January I took four calls from a neighborhood about five miles north of the zoo. They claimed to have seen the wolf standing by their mailbox and heard howling and saw tracks. I drove over to

check it out. I followed tracks that led from a mailbox back to a wooded area owned by Consumers Power Company. Sure enough, there were several bedding areas, wolf feces and an old deer hide he had been chewing on. There were signs of Apache everywhere, proving he had been in the area for many days if not longer. His feces were full of deer hair indicating he was feeding off of road kill probably from a highway just five hundred yards to the west. This made us very nervous about him getting hit by a speeding car and more anxious than ever to get him back.

We immediately called Wildlife Services and they promised to return immediately. The next morning, we used a fresh road-killed deer and some meat from our wolf diet to bait a trail the wolf had been using. Both Andi and I have four-wheel drive vehicles and were able to park in different areas to monitor the baited areas. We sat and waited. At almost exactly 1300hrs, Andi called me and was so excited I could barely understand her. Apache had walked out of the woods and was less than 30 feet from her vehicle. This was the first sighting of the wolf since his escape over three weeks earlier. We were ecstatic! We had dart equipment, but still did not have the permit in hand to capture him, though if he had gotten close enough, I would have tried to dart him anyway. Apache continued down the trail till he reached the deer carcass and meat we had left. I observed him eat a little meat, but then consume about five pounds from the flank of the dead deer. He wandered around the area scent marking and then disappeared again to the east. He was limping, favoring his left front foot, but otherwise appeared healthy. Had we known this was the last time we would see him alive, we may have tried a little harder to get a shot at him with the blowgun.



Tracks of escaped Mexican wolf Apache
(Photo by Binder Park Zoo staff)

Wildlife Services returned as promised, bringing specially designed leg hold traps they use to humanly capture and relocate timber wolves in the Upper Peninsula. They trained Andi and I on their use and how to set them up and conceal them in the snow and leaves. They were still very confident that they had this wolf in the bag.

The first step in the trapping process was to alert the local residents. We went door-to-door and talked to about eight families in the area. We explained what we were doing and asked them not to hike or walk their dogs back in the area as they frequently did. They were very cooperative and no one seemed concerned that a wolf was living in the area. They thought it was cool! We also had to get permission from Consumers Power to trap on their property which included about three hundred acres of woods and fields. We also set up warning signs that there were dangerous traps in the area and to keep out. We set up seven traps in the area where we had seen him the day before. One problem with the leg hold traps is that you need to get to the animal very quickly after they step into the trap in cold weather as they could lose their foot or toes to frostbite. The traps had about six feet of chain and a large hook at one end. This would allow the wolf to run for some distance before the hook became entangle in brush stopping the wolf. The theory was that the wolf would feel more secure at a distance from the trapping site and would be less likely to injure himself. We set up 24-hour surveillance of the traps. We took shifts throughout the night and day for the next week. At first we spent the entire night at the site, but then began driving in every two hours to check traps. Sitting in sub-zero temperatures for much of the night was not much fun.

Apache returned to the area for two nights after the traps were set based on tracks we saw and the condition of the deer carcass. Each night we would set more traps. However, he avoided every one even though they were extremely well hidden under the snow. Everyone involved, including Wildlife Services, were amazed and frustrated with his ability to avoid 14 traps scattered along the trail and near the deer carcass. The last we saw of the wolf in the area were tracks heading west across the highway which we followed through a neighborhood before we lost sight of them. Wildlife Services

had to once again return to the U.P. We had finally gotten our permit to recapture the wolf and they left us with the traps and a lot of good advice.

After a few more days, we finally pulled all traps from the area, but just in case, went back to check it at least once a day in hopes he would return. Over the next several weeks we followed up daily on every report we received. We sent out a new press release every two weeks or so to spike interest again. This always led to calls with new leads. Several of the leads were promising and traps were set up in a few more areas with no luck. The whole month of February was spent chasing false leads with almost no confirmed tracks or sightings. We began to lose hope of ever finding Apache, dead or alive.

Finally, on 9 March, about nine weeks after he escaped, Apache came home. We received a call from someone who had found what looked like a dead Husky lying between a country road and some train tracks in Vicksburg, over 20 miles south west of the zoo. Thinking it probably was a dog or a coyote, we headed towards Vicksburg. We soon received another call from a man in Vicksburg claiming he had our wolf and he had called the DNR and the local news to come get photos. He said it had been hit by a train and he had picked it up and put it in the back of his pick-up truck. We had a very bad feeling and drove as quickly as possible to the address given. Upon arrival we saw a group of men drinking beer and taking photos of a large animal in the bed of a pick up truck. The minute I saw him I knew it was Apache. He had very little trauma and appeared in good body condition and there were no immediate clues as to how he had died. All we wanted to do was get him out of there. The men seemed to be celebrating their find by taking each others photos with a beer in one hand and a wolf in the other. It was a very stressful situation and we were getting angry but made every effort to remain professional. The Conservation Officer arrived from the DNR shortly afterwards. We told him it was our wolf and were able to confirm this since Apache had been implanted with a microchip and we were able to locate it with our reader. The CO soon left and thankfully the media never showed up. The gentlemen said they were going to send the photos they took to the media, although if they did none of it was ever released. (The "gentlemen" later called the zoo to complain that we did not thank them very well for "finding" the wolf and we didn't even give them free zoo passes!)

It was a long silent trip back to the zoo. We were upset, yet anxious to find out how he really died. Dr. Tom de Maar, our staff veterinarian, along with the entire animal care staff, met us back at the zoo. Upon closer inspection, Apache was missing all but one toe on his left front foot and two toes on his right front. The wounds were cleanly healed and probably caused by a coyote or fox trap.



1.0 Mexican wolf "Apache"

(Photo by Binder Park Zoo staff)

Necropsy revealed trauma to the head and chest, more likely from a car than a train. No other injuries were noted and he had plenty of fat on his body along with deer hair and meat in his stomach. He weighed a healthy 63 lbs. (28.5kg). Apache seemed to enjoy his life on the outside and we take comfort that he got to live freely for a while without bothering anyone while he was out. It turned out to be a very positive experience with the public and the media, and we can't thank our community enough for their support. We sent out one last press release to announce Apache's death and to thank the community. The entire staff at Binder Park Zoo was completely supportive of our efforts, including our CEO Greg Geise, who gave us free reign to do what had to be done. To this day I still find myself driving down the road, still keeping an eye out for Apache.

Chemical Restraint of Exotic Animals in an Emergency Situation

*By Marilyn M. Baeyens, DVM
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Chemical restraint of dangerous animals during a crisis situation is a necessary and useful means of obtaining control and recapturing animals that are out of their normal holding areas or a danger to humans or other animals. The decision to do this must often be made very quickly and implemented in a short period of time. Previous training and planning are necessary to ensure a successful outcome to the immobilization. This is a team effort of not only the veterinary staff, but of the keepers in all the animal areas; not only in the area that is affected.

It is important to have written procedures for equipment handling, type of equipment needed, drug doses, drug handling, dart loading, and type of shots taken kept with each capture equipment storage site. In the event of an emergency, it is important that everything is in order and that procedures are performed in the proper way. These written procedures need to be updated as new equipment, procedures and drugs are put into the program.

Training and practice drills of the chemical restraint team cannot be emphasized enough. Everyone on the team needs to be intimately familiar with the equipment used by your zoo. Loading darts should be practiced repeatedly and continued practice should be scheduled. The handling of the drugs used in the darts when animals are actually out of their exhibits needs to be emphasized in the training program. All of these medications have the possibility of human danger if accidentally injected into a person, sprayed on mucous membranes or in the eyes, or in a cut or open wound, so not only is the initial handling in loading darts important, the line of fire in shooting an animal is also important so as not to accidentally inject or expose a person. Depending on the type of drugs used, a crash kit containing human antidotes and instructions for emergency personnel and hospital emergency room personnel should also be present at the time of use of these medications.

In the event of a multiple animal escape, communication between team members is extremely important. Animals must be observed as to their place on grounds, and a decision must be reached as to the order in which animals will be immobilized. Depending on whether there are multiple animals of the same species out, multiple animals of different species, animals that are unusually aggressive or timid, etc, will determine the route and order of immobilization. This is where the keepers are invaluable in helping to inform the team of the animals' traits and personalities and which animals might be unusually dangerous to the public. Multiple animals might need to be darted simultaneously by the team to avoid animals charging or attacking team members, or each other. Since the gun team also will be present during this procedure, they need to be armed and ready if needed.

After an animal has been chemically restrained, and all of the animals that had been out of exhibits are accounted for, then the animals need to be examined for physical injuries, treated as needed, and then put in a secure holding area. This may be the original exhibit or holding area, or other secure facility that has been constructed for emergency use. It is important to make sure that the animal is not only secure, but can be held in the proper size holding or caging area with proper temperature, bedding, water supply and feeding availability. Once this is done and the animal secured, then chemical reversal agents can be given if indicated.

Initial decision for procedures needed:

When a crisis management event has occurred, or in the case of anticipated events occurring, the senior veterinarian, management staff, and keeper staff need to be able to quickly analyze the situation and be ready to act immediately. If an event is anticipated, it is important to have equipment and

supplies stockpiled in safe areas that should be readily accessible when needed. This necessitates previous planning and organization for things that are unique to each facility. It cannot be emphasized enough for the importance of planning and training, and for this to be unique for each institution. Protocols need to be in place so that in the event not all the staff is present, everyone knows what to do and the proper way to do it.

Previous planning and training cannot be emphasized enough. Every institution is unique in the preferred equipment, drug usage and handling, equipment storage, and the personnel available to do the restraint procedures. There should be scheduled training sessions, and written guidelines for each type of equipment used. Also during training sessions the team learns to work as a team. The importance of teamwork can mean the difference between success and failure. When team members know the procedures and know the animals and can anticipate what the other team members will do, then a true team is working together. This team effort not only includes the emergency response team, but other staff members of the institution. That is why the other areas of the institution such as visitor services, grounds maintenance, etc. also need to be involved in the drill.

Written procedures:

There is the necessity of having not only the written procedures for equipment handling and usage, drug handling and usage, and dart loading prepared and available; but keeping written records of the actual event. This again is something that each institution needs to do for their unique situation. These written procedures need to be available for review and study during training sessions, and should also be kept in each storage area in a dry place. Lamination would be ideal. Blank forms for keeping records during the event are also important for several reasons. Drug usages (either spilled, off target darts, or darts that inject into the desired target) must be written down. Most of the commonly used immobilization drugs are required by government authorities to have a record kept of the date, amount used, and the intended animal used on. The forms need to also record the time of administration, place of administration, time to sedation and immobilization, animal identification, any other drugs or treatments administered, and any the outcome of the immobilization. There also needs to be a section for the follow-up physical exam of the animal for the purpose of recording any injuries or abnormal physical findings. These records become part of the animal's health records, and are also used for the follow-up analysis of the event after all animals are safely and adequately contained.

Drug types and dosages for each animal also need to be written down and kept with the drugs and equipment. It is ideal to have only a limited number of drugs to be used in an emergency situation. This will ensure that everyone can be confident in the usage of these immobilization agents. In a routine immobilization, individual animal preparations are ideal, but in an emergency, there may not be time to do ideal combinations and dosages. Also with the need for having multiple darts prepared that may be used on several animals, if a drug with a wider margin of safety is available, that is preferred to be used. Drugs with an antagonist are also preferred if available.

As new equipment is obtained, and new drug immobilization procedures become available, it is very important to update all the written protocols.

Training and practice drills:

The importance of actual hands-on practice and drills cannot be emphasized enough. Everyone on the team needs to be familiar with the equipment used by your institution. Loading darts should be practiced on a regular basis, and it is a good idea for each member to have a dart practice loading kit at home for the members to work with. In the event of an emergency, dart loading should be able to be done quickly and safely.

The handling of the actual drugs used in the immobilization needs to be stressed in the training program. All of these medications have the possibility of adverse effects to humans if there is exposure to them. Because they can be absorbed not only by injection but by contact to mucous membranes, eyes, and skin defects (cuts, abrasions etc), such drugs must be handled carefully. Gloves, eye protection, masks and long sleeved garments are ideal, but if not available, extreme care must be taken. Everyone on the team must be aware of the danger of these medications.

When a dart is fired, the possible line of fire must be considered. There is not only the danger of accidental human injection, but of the dart hitting an inanimate object and spraying drug onto a person. People need to be aware of the dangers involved in darting - they can be as dangerous as firearms discharging. Not only the person firing the dart needs to be observant, but all the team members need to assist in being aware of other things happening in the immediate area of the immobilization. During a crisis event there will be a lot of unusual and abnormal activity occurring.

There needs to be a crash kit on site in the event of an accidental human exposure to immobilization medications. Any antidotes available for the drugs being used, support care medications, written instructions and information for emergency medical personnel and emergency personnel also need to be in this kit.

Chemical restraint:

There is no ideal procedure and protocol that will be relevant to all situations, particularly in a crisis management situation. In these situations it is very important to be flexible and innovative in restraint procedures. Before any immobilization procedure it is very important to take a little time and thoroughly assess the current situation that you and your team will be working in. Think, discuss, and plan the immobilization procedure with the team that will be doing the immobilization. Look at all possibilities and be prepared for them. Observe the actions and attitude of the animal if at all possible. Be aware of other activities and personnel in the area and make certain that everyone is aware of what needs to be done to be safe. Inform the other personnel in the area of the procedure that is about to be performed. Get the proper drugs and the proper doses calculated correctly, and also the reversal agents, if they will be used. Make sure they are measured out correctly and that the darts are loaded safely and correctly. Do the record keeping so that others are aware of the type of drug, amount, and time of delivery, and if at all possible record the place the dart impacts the animal. It is preferable to take a few minutes prior to the immobilization procedure and think things through with the team then to go into it too fast and make an error that could have been avoided. Particularly in an emergency crisis situation everyone needs to be calm and thinking the procedure through in the same manner. If the animal is in a situation that you feel must be rushed into too fast so that human injury could be avoided, then a gunshot might be the best method of stopping the animal. These are all things that must be discussed in advance at team meetings before the emergency situation presents itself.

Handling the immobilized animal:

Several immediate steps need to be taken once the animal can be safely handled following immobilization. The steps listed may be changed in the order listed if an emergency condition of the animal presents itself.

- Position body correctly. Insure that nothing interferes with respiration. Make sure the nose and mouth is clear, and that the neck is straight
- Position ruminants sternally or on their right side. Placing ruminants on their left side can cause bloat or other complications from the rumen gas and contents. Other animals can be placed on either side or sternally. The exception is elephants that must be placed on their sides. Preferably the head is placed slightly lower than the thorax to prevent aspiration of fluids.
- Flat surfaces are preferred to position the animal on. This prevents occlusion of the trachea, pressure neuropathy, or circulation impairment.
- If the animal must be kept immobilized for an extended period of time (which in an emergency situation is likely), turn the animal to its other side or sternally at least every 60 minutes. Roll ungulates across the sternum rather than across the back to avoid torsion of the abdominal organs.

- Cover the eyes and place bland ophthalmic ointment in both eyes. This prevents damage from ultraviolet light, and drying. If needed, saline solution (intravenous solution, contact lens solution) can be used to moisten and clean the eyes.
- If the animal has been immobilized with an opioid (carfentanil, etorphine) sharp, sudden noises should be avoided (like the slamming of a door or other sudden noises). These animals can spontaneously respond with a kick or even try to stand. It is often valuable in an emergency situation to plug the animal's ears with cotton or fabric, since absolute quiet cannot be achieved in an emergency situation.
- Once the animal is positioned correctly and is breathing normally, vital signs need to be monitored. Respiratory rate and heart rate are monitored by observation of chest movements, palpations of pulses, and stethoscope usage. A portable pulse oximeter is invaluable for monitoring respiratory efficiency since they measure the level of oxygen saturation of hemoglobin in the blood stream. Oxygen saturation should remain above 90%, and if it falls below that for any period of time the cause should be ascertained and corrected.
- Heart rates should be monitored. A fast heart rate could be the result of the immobilization drugs or physiological responses to stress, shock or hyperthermia. An abnormally slow heart rate could be the result of immobilization drugs or physiological responses to hypothermia or metabolic disorders. If the capillary refill time is normal, no other action is required if no other abnormal signs are present.
- Body temperature should be monitored, especially in hot or cold situations. If body temperatures fall below 98°F (36.6°C) or above 104°F (40°C), the environmental conditions need to be modified to correct it. During the immobilization process, if the animal has been stressed or unusually active and excited, the body temperature will rise quickly, even in moderate environmental temperatures.
- After the animal is determined to be stable, the body of the animal needs to be checked for injuries. If escape from the exhibit was due to an explosion or violent storm, wounds and injuries are probably likely. Start at the head of the animal and work toward the rear of the animal. Look for blood, swellings, hair loss, and abnormal position of body areas, as this could indicate fractures or dislocations of the joints of the skeletal system. In carnivores thoroughly check the mouth for sticks that may be lodged in the teeth and for broken teeth if they have been trapped in a small area and have tried to escape by chewing. Listen to the chest (should have been done when checking heart rate) for gurgling moist rasping sounds that could indicate internal injuries and bleeding, or water aspiration. Check the abdomen for signs of bloat. Check the feet for lacerations, burns, fractures of toes or hooves, and imbedded foreign bodies. Check the rectal area for bleeding - anal bleeding and diarrhea may be due to hyperthermia, stress, or a foreign body. The skin should be checked for abrasions, lacerations, burns, imbedded foreign bodies. Dehydration may be checked by pinching the skin to form a tent, and monitoring to see how fast it reverts to its normal configuration. It should fall back to normal position in 1 to 1.5 seconds. If not, dehydration is a possibility and needs to be monitored.

The animal (or animals) should be closely monitored until they are showing signs of recovery. They should be able to raise their head, and be able to hold itself in a sternal position. Hopefully a reversal agent has been administered to speed the recovery period. The use of a reversal agent is very useful when immobilizing multiple animals at the same time.

Euthanasia, if indicated:

There will be times in a crisis situation that a decision must be reached if the animal is deemed too injured to be humanely recovered. It may be evident before the animal is immobilized (i.e. a large ungulate with a badly fractured leg, an animal with large gaping chest or abdominal wounds, or

other observed critical injuries.) Other critical injuries may develop or become evident after immobilization. These may be injuries that could be possibly corrected in an ideal situation, but if there is no critical medical care available, euthanasia may be the best alternative for the animal. Euthanasia should be performed in the most humane method available. Ideally barbiturate euthanasia injectable solution is available to be given intravenously.

In summary, proper planning and preparation play a vital role in the successful outcome of an emergency situation. Time spent practicing and developing teamwork prior to the emergency situation will play an important part in the favorable outcome of the situation. Everyone desires a successful end to a bad situation, and proper planning and preparations can help ensure this.

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The Veterinary Role as First Responder to a Medical Emergency in a Crisis Management Situation

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Abstract:

The use of firearms to contain dangerous animals is an established wildlife management technique in zoological institutions. Historically, the use of firearms in crisis management situations involving dangerous animals has been noted to be statistically significant. Recent international events indicate that a viable threat potential exists for human injury or mortality during a crisis event. This clearly indicates that veterinary personnel may be required to act as medical first responders to a firearm-incurred injury until paramedics arrive on site. As a result, emergency medical response training is recommended. It is anticipated that injury rates will continue to increase in proportion to event occurrence and that further research is indicated.

Key Words: Animal escapes, CMT, crisis management, Crisis Management Team, dangerous animal escapes, Emergency Response Team, ERT, first response, gunshot injury, trauma, weapons response, zoological institutions.

Introduction

During the past few years a new variant has developed within zoological crisis management situations. In several instances the lives of emergency responders and bystanders have been placed at risk by an inappropriate use of firearms while attempting to resolve crisis events. In one event a veterinarian was killed and in two unrelated events people were injured by gunfire. As a result, it has become necessary to examine the data and circumstances associated with the events in question. It is the intent of this examination to ascertain what procedures would be necessary to prepare, prevent, or respond to a crisis situation when firearms are used inappropriately during a dangerous animal situation.

Event Data

On March 14, 2000 in Warsaw, Poland, a veterinarian was killed when police officers opened fire on an escaped tiger. This event data in and of itself is cause for concern. However, three other unrelated incidents have occurred since the first and all closely parallel each other in key areas. While all events involved the use of firearms, it should be clearly noted that it is not the purpose of this paper to dissuade the use of firearms in a crisis management situation. The use of firearms to contain dangerous animals is an established wildlife management technique in zoological institutions. Historically, the use of firearms in crisis management situations involving dangerous animals has been noted to be statistically significant.

The North American Crisis Management Survey is the best resource of statistical data in this regard. The survey was sent to 187 zoological facilities in North America and 79 responses were received, resulting in a response percentage of 42.25%. When asked, "Does your facility have an Emergency Response Team or Crisis Management Team?" 69.62% answered Yes, while 30.38% answered No. When asked, "Does your facility have an emergency procedure for escaped animals, and dangerous animals?" The answers were respectively 94.94% Yes, 3.80% No, and 87.34% Yes, 11.39% No, to dangerous animals. When asked, "Does your facility conduct scenarios or practice drills for a possible animal escape situation?" respondents indicated 62.02% Yes and 37.97% No. In regards to facilities having animal escapes, 77.21% Yes and 22.78% No, and of those who answered in the affirmative of escapes also indicating 20.25% dangerous animal escapes. With the applicable baseline, firearms usage can be examined. As to whether firearms are maintained onsite for dangerous animal situations, respondents indicated 73.42% Yes and 25.32% No. When asked, "Has your facility ever had to use firearms kept onsite for a dangerous animal escape situation?" 17.72% Yes and 75.95% No. Respondents clearly indicate while escapes do occur, they also have contingency planning, keep firearms on site, and are prepared to use them in the event of a crisis that involves dangerous animals, thereby establishing a historical context. In order to better understand the threat potential of inappropriate firearms usage, it is necessary to review the crisis management events in chronological order:

March 7, 2000. Warsaw, Poland

Three Bengal tigers (*Panthera tigris tigris*) were intentionally released from their circus cages by animal activists. Two of the tigers were recaptured before leaving circus grounds. However, one remaining tiger escaped into city streets after injuring a circus employee. This tiger was then pursued for approximately two hours by police and an assisting veterinarian through the busy streets of Warsaw. The tiger was finally cornered on a wasteland near housing blocks in the Warsaw suburb of Tarchomin, located in the eastern part of the city. The veterinarian then fired a tranquilizer dart, but was chased and attacked before sedation could occur. Police officers then fired a volley of shots and the veterinarian was struck in the head. The 47-year old veterinarian, identified as Ryszard Karczewski, died later in hospital. The tiger was shot to death by policemen armed with rifles and pistols. The Rzeczpospolita daily newspaper received an email from a group identifying itself as the Polish League for Protection of Animals. The message claimed that, "Once a week we will release animals from a circus or a zoo." In review of the event, Warsaw Police Chief Antoni Kowalczyk acknowledged that the police appeared to have mishandled the chase, but said that they were ill equipped to handle such an unusual occurrence

April 3, 2000. Sao Paulo, Brazil

José dos Santos and his son José were touring the animal cages during a break interval of a performance by the Vostok Circus in the northeastern city of Recife. Inadvertently, they approached too close to a cage. The six-year old boy was pulled from his father by a lion (*Panthera leo*) and into a cage with four other lions in front of hundreds of spectators inside the tent. As the lions devoured the boy, police arrived on the scene and in an attempt to scare the animals away, sprayed the top of the cage with machinegun fire, wounding two bystanders with bullet fragments in the process. The boy's body was recovered several hours later when police officers shot four of the five lions dead. A circus worker indicated that the lions had not been fed in five days. Police are investigating to establish whether the circus owners breached safety regulations by allowing the public to walk directly up to the cages. The lion tamer has been charged with manslaughter.

August 4, 2000. San Simao, Brazil

Six circus lions (*Panthera leo*) were being housed at the zoo after local authorities determined that the lion's traveling cages were not sufficiently secure. After escaping from their cage at the zoo, the lions roamed this town in southeastern Brazil until they were shot and killed by police firing machineguns and shotguns.

August 12, 2000. Boise, Idaho

While the zoo manager of Zoo Boise was conducting an unscheduled behind the scenes tour of the Amur tiger exhibit, a tiger (*Panthera tigris altaica*) escaped through an open cage door. The tour occurred during the zoo's 12th annual "Feast for the Beast" fundraiser. As the tour group entered the building they lined up against the wall of the keeper service hallway. Friend's of Zoo Boise board member, Jan Gould, who was located at the end of the line, was attacked by the tiger that pinned her by the head and shoulders. Sgt. Rich Schnebly of the Boise Police was accompanying the group and attempted to distract the tiger with a thrown bucket. When this failed he fired his pistol three times forcing the cat finally back into the cage and allowing the door to be closed. However, in the process of firing his sidearm, one of the shots ricocheted and struck Ms. Gould in the leg. She was then transported to Saint Alphonus Regional Medical Center for treatment of the gunshot wound and lacerations of the head, neck, and shoulders. Zoo Boise veterinarians and staff members sedated and thoroughly examined the tiger and found no evidence of injury or gunshot wounds.

To review, four of the events involve dangerous animals (cats), police, and firearms usage. In three of the events, people were either injured or killed. And, in all cases there was a questionable tactical use of firearms, not only in application, but the types of firearms that were utilized during the situation.

Event Resolution

In light of the aforementioned events, it is clear that zoological facilities and wildlife managers should take preemptive measures. The threat potential for human injury or mortality in the process of resolving a crisis management situation is present. As a result, it is recommended that animal professionals factor into their emergency contingency plans the following points to facilitate an effective resolution to a crisis involving dangerous animals:

- Veterinarians inherently have a higher degree of medical knowledge than other staff members in a zoological institution. It is also likely that the veterinarian and their medical staff will be involved in a crisis event. As a result, the veterinary staff would be the logical choice for training in first responder treatment in emergency first aid and CPR, such is offered by the American Red Cross.
- A dialogue should be developed between veterinary professionals and medical providers who have experience in the treatment of gunshot injuries, violent trauma, and triage techniques. This exchange of information would be applicable not only in isolated cases, but invaluable in the event of a natural disaster, due to the potential for widespread human and veterinary casualties.
- Major cities worldwide indicate that they are experiencing problems in first responder times due to urban growth, call loads, and associated traffic problems. All of which lengthen response times to the incident site and could jeopardize survival of critically injured parties. Facilities that do not maintain Emergency Medical Technicians (EMT's) on staff should consider sending a member of the veterinary staff through a recognized and certifying emergency medical technician course.
- Trauma equipment kits for human usage should be maintained in multiple locations throughout a facility, with special emphasis on access for the veterinary staff. Kits should offer treatment options for a wide range of injuries, but focus on severe trauma

treatment. To date, the best examples for zoo usage are produced by Zee Medical and Certified Safety Manufacturing (CSM).

- Crisis management situations that involve dangerous animals require resolution of the animal aspect of the crisis before treatment of human injuries can begin. This only increases the need for having at least two members of the veterinary staff trained in treatment of human injuries. Especially when considering that more than one person could be injured at a given time or place.

Discussion

The problems associated with resolving crisis management situations are not only complex, but multifaceted as well. Local governments no longer see performance measurement as an option, but as a requirement. They have identified the four key areas, which influence first response medical care in the field: response time, effectiveness, workload, and cost. Unfortunately, these areas are at odds with the previously mentioned: urban growth resulting in higher demands, coupled with higher population density, higher call loads, and traffic problems which translate into delays in the field to reach injured parties.

Yet, at the same time the public has shown an accelerating trend and aversion to supporting tax initiatives that would empower public officials to raise revenue in order to provide more effective vital services to their communities. While at the same time professional organizations such as the National Fire Protection Association (NFPA) are considering adopting national standards for minimum response times.

When considering the issue of gunshot wounds themselves, the annual medical cost in the U.S. is close to \$2.3 billion, with staggering associated injury and mortality rates. Conversely, this has created a wealth of treatment data for the medical professional to draw upon. Still, this should be tempered by the realization that while most medical providers do treat gunshot injuries, they are unlikely to have encountered a wound inflicted by a high-velocity safari grade bullet that was designed specifically to penetrate, expand, and cause maximum tissue destruction. As a result, a well-trained vet staff is an asset.

Conclusion

As crisis managers we should be aware that precedence necessitates a need for proactive measures. Still, we must keep in mind all of the hypothetical components that could lead to gunshot injury and act accordingly to prevent the incident from occurring in the first place. This can be facilitated through study, evaluation, and training. The basic factors of animal behavior cannot be dismissed such as primary signs of aggression or the "fight or flight" response with their associated distances and resulting actions, such as an animal attack resulting in either conspecific or human injury. Law enforcement agreements should be reconsidered in light of the previously mentioned events, as zoological professionals appear to be the better equipped and trained personnel for resolving dangerous animal situations. The use of firearms in a crisis is a viable option, but it should be tempered by the skill and experience of the responders.

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Critical Incident Stress Management: A Proven Tool for Addressing Staff Needs After a Traumatic Event

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What is CISM?

Critical Incident Stress Management (CISM) originated to help emergency response personnel recognize and alleviate the stress caused by traumatic events experienced as a part of their work (Everly & Mitchell, 1992). Traumatic events such as natural disasters, man-made disasters, line of duty injuries or death, extensive injuries, or loss of a victim's life are events that rescue workers may have to reconcile. CISM is a comprehensive, multicomponent crisis intervention program that aids first responders in dealing with the stress caused by traumatic events (Mitchell & Everly, 1998). Fire and rescue units, law enforcement, military, and a variety of community agencies practice CISM worldwide (Everly & Mitchell, 1992).

Do Zoos Need CISM?

When an animal escapes, a staff member or member of the public is injured or dies, or an animal is injured or dies, zoo staff are most likely the first responders. Zoo staff serve on emergency response and immobilization teams, emergency weapons teams, guest relations and public relations teams. Not only do they respond to the emergency, but they are also responsible for cleaning up after the emergency and facing intimidating and persistent press questioning. Answering to higher and legal authorities during follow up can also be extremely stressful.

When a natural or mechanical disaster occurs at a zoo, zoo staff are again often the first responders to the crisis. They may be the only responders as in the case of hurricanes Andrew, Ivan, Katrina, and Rita. They may be isolated for days after a disaster. They are in most circumstances, responsible for all of the clean up and rebuilding after a disaster. They may be working long hours for the animals and the institution, when their own families, pets, and homes are in jeopardy. The accumulated stress of dealing with all of these crises needs to be alleviated for the benefit of the staff and the institution.

All levels of personnel within a zoo can be negatively affected by the stress caused from a traumatic event. If visitors have to be ushered to safe locations or suffer injury or death, any staff member at the zoo may be involved. Even staff who were not at work during the emergency can be affected by the emotional response or stressful follow-up duties after a traumatic event. Follow up activities after an emergency can last for months after the actual occurrence, thereby extending the effects of stress on the staff.

Mitchell & Everly (1998) state that a crisis results when a person's usual coping mechanisms fail in the face of a perceived threat to their physical integrity or to someone in close proximity. Zoo staff members who serve on emergency response teams may be placed in unsafe and demanding situations requiring instantaneous decisions. These decisions can be critical to the safety of visitors, staff and the animals. Staff members who serve on weapons teams may also be placed in unsafe positions, be required to make instantaneous life-preserving decisions, and be forced to shoot animals to which they have an emotional attachment. Immobilization team members may be handling drugs that are dangerous or fatal to humans during a stressful emergency event, as well as expose themselves to danger from animal attacks. Zoo staff members who are asked to clean up after an emergency may also experience disturbing images and emotions thereby adding to their stress levels.

What is Traumatic Stress?

Stress reactions to a traumatic event are normal, and ignoring the symptoms can be harmful to individuals and the organization. Individuals vary in their responses and the intensity of their responses. Expected symptoms resulting from a stressful event include impacts on cognitive ability, such as confusion, difficulty making decisions, nightmares, hyper vigilance, and/or blaming others. Physical symptoms include, but are not limited to, fatigue, nausea, increased heart rate, elevated blood pressure, and/or headaches. Emotional signs of stress include emotional shock, anger, grief, depression, denial, anxiety, a feeling of being overwhelmed, and/or hopelessness/helplessness. Behavioral impacts include changes in ordinary behavior patterns, changes in eating, decreased personal hygiene, withdrawal from others, restlessness, and/or increased consumption of alcohol or tobacco. (Mitchell ... Everly, 1998).

Symptoms may appear immediately, or a few hours or days after the event. Symptoms may last days to months after the event. When traumatic stress overwhelms a person's ability to cope long-term (more than one month), the person may be experiencing Post Traumatic Stress Disorder (PTSD). Everly & Mitchell (1999) estimate that 10% of individuals exposed to a traumatic event can be expected to develop chronic PTSD. Individuals experiencing PTSD symptoms such as flashbacks, traumatic dreams, persistent intrusive recollections of the trauma, self-medication, panic attacks, anger or hostility that is difficult to control, persistent depression and/or withdrawal, and/or a dazed appearance should be referred to a mental health professional (Mitchell & Everly, 1998).

What is Involved in a CISM Program?

CISM is not psychotherapy; it is more like emotional first-aid to help individuals cope with resulting stress from overwhelming events (Everly & Mitchell, 2000). It teaches methods to recognize stress symptoms, techniques to manage this stress, and provides additional direction to available resources when needed. A CISM team consists of a partnership between mental health professionals and staff members interested in preventing and mitigating the negative impact of acute stress on themselves and their co-workers (Everly & Mitchell, 1992). It involves work peers who understand the organization and its culture, helping their colleagues through a critical incident. Every CISM team should have participation and support from a mental health professional, and although the mental health professional oversees certain aspects of the program, the process is primarily peer-driven (Mitchell & Everly, 1998).

The goals of a CISM program are to: 1) prepare for crisis by improving coping mechanisms and providing stress management education; 2) provide immediate post-crisis defusing, stress management education, and assessment of individuals, and 3) provide follow-up care through peer support, group intervention, and referrals for further care if needed (Mitchell & Everly, 1998).

Forming a CISM Team

When deciding on whether to form a CISM team, the first step is to identify need. If your institution has experienced a number of major crisis events over a five-year time span, forming your own CISM team could be the best solution. If your institution experiences very few crisis events, it may be more effective and practical to link with a local or regional CISM team willing to work with your staff. (Mitchell & Everly, 1998). The Dallas Zoo originally asked for the assistance of the Dallas Fire and Rescue Department (DFRD) CISM team after a chimpanzee escape from zoo grounds and subsequent death from contact with an electrical wire. After assisting the zoo staff through this crisis, the DFRD recommended that the zoo form its own CISM team and seek formal training.

The Dallas Zoo still draws upon the support and assistance of the DFRD, although on occasion has operated independently, such as after the 9/11 attacks. When a traumatic event occurs within a tight knit, insular institution like a zoo, it is hard for zoo team members to remain non-affected by the trauma. The DFRD CISM team leaders work together with our CISM team members when a crisis occurs. Having the assistance of an unrelated, trained CISM team with mental health professionals has been invaluable to our institution. Our CISM team members are most effective at peer support, assessment and referral for further assistance (clergy, mental health professionals, etc.). Peer support can be intensive and time-consuming, but it is also the most readily available form of assistance and perhaps the most effective for many staff members. After a recent gorilla escape and death, the

Dallas Zoo CISM members spent follow-up time with peers every day for a full month before most of the staff had regained their individual coping mechanisms.

Obtaining administrative support is important to the success of a CISM team (Mitchell & Everly, 1998). Buy-in from the management of the institution ensures that your team will receive training and continued support. The Dallas Zoo's Director was initially responsible for obtaining the assistance of the DFRD CISM team, and has been instrumental in obtaining continued training for Dallas Zoo staff.

Potential team members should apply to join the team (Mitchell & Everly, 1998). CISM training will provide assistance with selection criteria for team members; zoo team members will naturally have empathy for both humans and animals. Team members should be compassionate, good listeners who voluntarily apply to join the team. Because zoo CISM team members must be able to listen to and assist all zoo staff members, it is important to have all divisions and levels of the organization represented on the team. Staff members may not feel comfortable talking to particular individuals on a team because of personality conflicts or their positions within the organization. Institutions with multilingual staff should consider placing staff conversant in languages other than English on their teams. The Dallas Zoo CISM team consists of a senior staff member, mid level managers, and front line staff. The current team consists of members from the animal department, the education department, and the maintenance department. Three ethnic groups are represented on the team and two members are bilingual. One member is on the Emergency Weapons Team, another serves as an Emergency Response Leader, one serves as a weekend Duty Officer, and one provides Emergency Public Relations. One member works as a night keeper/supervisor. Both men and women serve on the team.

CISM Training

Training needs to be organized once team members are selected. Training courses for CISM are held throughout the country. Information can be obtained from the website for the International Critical Incident Stress Foundation (ICISF) at www.icisf.org. Another source for information could be local fire and/or police departments. The Dallas Zoo was invited to join the Dallas Fire and Rescue Department for training. At the training we were joined by fire, police, hospital, and mental health professionals from Texas and surrounding states.

CISM training is available on multiple levels. The Dallas Zoo participated in Basic, Advanced, and Peer Support training. Each course lasted two full days. The Basic and Advanced training is very useful in dealing with traumatic events that affect large groups of people. The Peer Support training prepares the team member for intense individual intervention that could result from a large crisis at the institution or individual trauma. CISM classes educate team members on how to prepare and respond effectively to stress resulting from a crisis. Emphasis is placed on organization and communication techniques; classroom time includes lecture, discussion, and role-playing scenarios. The training was challenging and emotionally tiring, many experiences in the training session were stressful in themselves.

Effectiveness of a CISM Program

CISM is employed around the world after crises, and data support that CISM programs are effective in reducing the negative aspects of crisis induced stress (Everly & Eyler, 2000). One comparison between an airliner crash without CISM and a crash with CISM revealed greater job retention and no suicides among emergency workers who received CISM (Donaldson, personal comm.). Suicide rates are known to increase after natural disasters, and high risk professions – such as police, are more likely to die from suicide than from homicide or accidents (Everly & Mitchell, 1999)

The Dallas Zoo has experienced traumatic events without CISM and traumatic events with a CISM program in place. Team members who experienced both scenarios have noted observable differences in staff responses. Without CISM our institution came to a standstill and was literally under emotional arrest, staff members talked anonymously to the press, emotional outbursts were common and unchecked, and several resignations ensued. With a CISM program in place, we have experienced equally devastating events, but our post-event response has been more controlled and has not resulted in uncontrolled public outbursts, individual actions, and very few resignations have occurred as a

result of the crises. There is still more emotional feeling and discussion among the staff resulting from a 1998 trauma without CISM as opposed to more recent crises in 2000 and 2005 with a CISM program in place. Even though the 2005 crisis was potentially of greater magnitude, staff members seem to have recovered faster and with fewer lingering signs or symptoms from the trauma.

Conclusions

The Dallas Zoo has found its CISM program to be a very useful internal resource. We envision that we can assist other zoological institutions in our region when or if they ask for assistance. Trained peers from fellow institutions could be extremely helpful in assisting a zoo through an institution-wide crisis. Empathy to animals is an important factor for zoos to consider when asking for help from a CISM team. The Dallas Zoo has found that the Dallas Fire and Rescue Department is able to cross the line from empathy for humans to empathy for animals also. However, within our training courses we encountered several other public safety personnel who were perplexed by the zoo's involvement in the course. Not all trained CISM teams may be suitable to respond to zoo-related crises. Likewise, zoo CISM teams may not be prepared to respond to non-zoo crises.

A North American network of zoo CISM teams is a dream that Dallas Zoo staff would like to see develop into a reality. We envision that zoos could help each other financially, physically, and emotionally during crises. Receiving emotional support from peers during a work-related crisis could be an invaluable resource. The ability to talk to someone who understands your job, your priorities, and the pain that you feel puts your recovery from stress a step in advance. A network of zoo CISM teams could provide a safety net of peers to help institutions and their staff through a variety of crises.

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Developing a Program for Dangerous Animal Emergencies: Procedures for Animal Escape, Unauthorized Person in with Dangerous Animals, and Unified Command System

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One of the questions many of us in the zoo profession have been asking recently is: "Are there more dangerous animal incidents these days or are they just better reported?" In one recent three-year period a survey of the Internet revealed almost two dozen dangerous animal escapes, some resulting in serious injuries, involving great apes, large cats, and elephants. These involved Association of Zoos and Aquariums accredited zoos, non-accredited and roadside zoos, circuses, sanctuaries, and private owners. Whether they occur by exhibit design error, equipment failure, human error, or some quirk of nature, they happen, and we are irresponsible if we are not well prepared. Since 1998, the Emergency Procedures for Dangerous Animals at the Dallas Zoo have evolved in response to several animal emergencies (Kaemmerer 2000, Kaemmerer and Piwonka 2001). We focus on three major tasks: safety of public and staff, containment of the animal within the zoo, and strategy for safely searching for and capturing the animal. While these procedures were developed at a large zoo, many of the same principles and equipment can be utilized in medium or smaller zoos allowing a faster and safer resolution to a dangerous animal emergency. We will provide a summary of our procedures, our equipment and our training for you to evaluate, to compare and hopefully to improve your program for dangerous animal emergencies.

Public and Staff Safety

In a dangerous animal emergency, safety of the public and staff is first and foremost. In a dangerous animal escape, visitors are quickly corralled and moved by all nearby staff to pre-planned designated "safe places," e.g. hard-walled lockable buildings, lockable aviaries, or even out of the zoo entirely. A list should be compiled of all such places in an institution, how many they can hold, and what dangerous animals they are safe from (e.g. carnivores vs. great apes vs. elephants). Staff should be trained on the safe place locations as well as on procedures to identify numbers and even names and contact information of the inhabitants; a first-aid box mounted in each safe place can hold paper and pencil for staff to record information. If at all possible, a staff member should stay with the public to calm and explain the procedures and to communicate with the command post any vital concerns (e.g. injuries, separated families, heat and water needs). Some time later after the initial emergency actions are organized and begun to be implemented, a "roll call" of safe places is made to staff on a separate radio channel to identify the status of all contained persons.

If there is imminent danger of injury to public or staff, a two-member weapons team is immediately dispatched to the vicinity of the escaped animal to provide protection. If there are public or staff who need to be "rescued" due to injury or other reason, the Emergency Response Team (ERT) leader can send out a "rescue team." The rescue team is comprised of two to three weapons team members, a team leader, a police officer and two paramedics with equipment. The "rescue" takes priority over capture strategies until the rescue is completed. Either after the emergency is over or if the command post leader feels it is safely warranted during the emergency, contained persons can be orderly evacuated. If possible, names and contact information should be gathered for guest relations efforts and the post-incident investigation.

Assembling Emergency Staff

While visitors are being escorted to safety, various emergency leaders and designated team members radio in their confirmation and meet up at a pre-arranged "Command Post" (CP). These staff include the overall Emergency Response Team leader; the back-up person to the ERT leader (Operations

Section Chief) who manages the Staging Area and resources; the Emergency Immobilization Team (EIT) leader and teams, comprised of veterinarians and technicians; the Emergency Logistics Team (ELT) leader who can direct staff to bring vehicles or equipment at the request of the ERT leader; and the Emergency Weapons Team (EWT) leader and available weapons teams (for further information on the Emergency Weapons Team, see Piwonka and Kaemmerer, this volume). The first responding police officer who arrives can act as the communication liaison between the ERT leader and other police, especially since the police radio frequency may be different from that of the zoo; this should be agreed upon previously with the police department.

A Command Post (CP), which serves as an assembly point of emergency leaders for planning and coordinating, should be selected in advance and known to all, especially to outside responding police and fire-rescue personnel. This eliminates the problem of using extra time to select one on the run (note: These days, visitors with cell phones may call "911" before zoo staff discover the emergency, resulting in police/fire-rescue responding indiscriminately to any and all zoo entrances unless they are trained to respond to only one entrance leading to the command post). If the initial CP is deemed inadequate, unsafe, or needing to be closer to the action, then it can be moved by the ERT Leader. Much like "generals," emergency leaders should stay at the CP to direct the overall operation, liaison and communicate with staff, police, etc. and be able to order equipment and supplies needed for search and capture. The advantage is that the leader can look at the "bigger picture" in knowing and deciding on the placement of teams and resources even though the leader must rely on others to view and communicate the animal's actions.

One of the best tools to be used at the Command Post is a pre-positioned large map of the zoo and surrounding neighborhood streets. This map should have all current buildings, exhibits, fence lines, gates, roads, pathways, and every other useful feature that leaders need to know (Figure 1). Because the Dallas Zoo is geographically split in half, we have separate 3 X 6 ft. maps of each side. The map should be large enough to be viewed easily by the various leaders and have the capability to be drawn upon (utilizing a clear plastic overlay and erasable markers pre-positioned at the CP) or be used with small "game" pieces to represent the animal, teams, and resources (also pre-positioned).



Fig. 1 - A map of the zoo, large enough for emergency reponse staff to surround, is very important for planning.

All communication should proceed to or from the Command Post on one primary channel of one radio network. (Note: If police and/or fire-rescue personnel are involved, their radio network may not be compatible with yours.) Advanced communication and planning with police and fire rescue can help ensure that there will be combined efforts with sharing of radios and/or with ensuring that zoo staff and police/fire-rescue elements work together so both sides hear each other's radios and know what all members are doing.

Pre-planned and staged aids should also be available for writing lists of resources, personnel names on task force teams, descriptive notes, etc. Besides paper and pens, these aids can include large write-on/erasable boards, smaller detailed zoo maps for all zoo and outside personnel, a staff member to record notes, etc. It is extremely helpful if someone is assigned to tape record all transmissions on the radio, as well as to note times and identify speakers during an event; a tape recorder should be staged, reserved only for emergencies/drills and accessible to the person(s) assigned for recording. Accessibility to telephones and numbers for staff to call in from

event; a tape recorder should be staged, reserved only for emergencies/drills and accessible to the person(s) assigned for recording. Accessibility to telephones and numbers for staff to call in from

home as needed should also be available; likewise, a "phone-tree" of staff's home or cell phones will allow them to be contacted and recalled.

It is best to keep media from distracting or interrupting the Command Post personnel by designating a geographically separate "Media Staging Area" with an authorized zoo representative who can pleasantly interface with the media (but with instructions not to speculate on cause or ongoing procedures). All media should be directed to that location, with police assistance if necessary.

Adjacent to or near the Command Post should be a "Staging Area" which is large enough to accommodate numerous staff, police and/or fire-rescue personnel. This allows for the orderly assembly of vehicles and equipment and for the assembly of smaller groups, such as search or rescue "task forces" about to move out on assigned duties. It is important to have a designated person (Operations Chief) other than the ERT Leader to manage this area. Their duties include keeping track of incoming individuals and equipment and assembling task forces and equipment to move out on orders from the ERT Leader. Because the Staging Area can be quickly flooded with incoming vehicles, causing a traffic jam and possibly impeding the deployment of task force vehicles, it is helpful to assign another person, (staff or another police officer), to assertively direct traffic and the parking of incoming vehicles to maintain clear traffic flow for necessary vehicles.

Protection of Staff

Protection of staff directly involved in the observation, search and capture operation is more problematic. Staff can be instructed to put on brightly colored ball caps or safety vests so that they can be clearly identified from a distance and through vegetation. The primary concern is that they can be seen and not fired upon by the Immobilization and Weapons Teams. The caps or vests also help identify staff to outside respondents such as Police and Fire personnel. At the Dallas Zoo, a red vest is designated only for the Emergency Response Team (ERT) leader; orange is assigned only to Emergency Weapons Team (EWT) members and fluorescent green is worn by all other participating staff.

Because an animal can move rapidly, we set up a broad encircling perimeter of staff some distance from the reported vicinity, so that its location and behavior can be reported, and a search and capture strategy developed. But how do you set and protect a perimeter of observers knowing that the dangerous animal may suddenly come upon them? The staff is instructed to work in pairs or be within 20 ft. of each other. They should have a radio, carry pepper spray (Counter Assault Bear Deterrent®) and may additionally have a CO₂ fire extinguisher. They should also be in close proximity to a secure building, vehicle, or behind a fence. Some observers should be strategically placed at high points, such as rooftops, to see a greater area; identifying these high points in advance and determining their range of views both in summer and winter will aid the quick planning at the CP.

Strategies for the Containment of the Animal within the Zoo, the Search and the Capture

Containment of the escaped animal within the zoo may be aided by placing and closing permanent gates along stretches of service roads, especially where exhibits, buildings, and natural geographic features form "choke points." In addition, temporary animal barrier nets, rolls of shade cloth, or rolls of construction fence can be quickly deployed to form barriers; this equipment can be stored nearby for emergencies. Vehicles placed across roads may be effective in blocking some animals. Finally, whenever areas of the zoo are being newly built or renovated, strong consideration should be given to designing and building non-climbable perimeter fences with a height greater than the USDA/AZA standard of eight feet.

In developing a search strategy we utilize a military model. The ERT leader sends out small "task forces." A search and capture task force is comprised of one leader, two or three weapons team members to protect the front, flanks and rear of the team, one veterinarian or trained dart shooter for immobilization, and one veterinary assistant for dart preparation and support. The task force leaves the CP in a protected vehicle and then goes on foot if authorized. If the staffing is available, one task force can respond directly to the last sighting and a second task force can wait at another strategic location so that each team covers exclusive zones. A second waiting task force can more quickly respond should the animal escape the initial zone.

A capture strategy must involve "how" and "with what." Depending on the animal and location, does

immobilization mean shooting a tranquilizing dart? Can staff attempt a net capture? Can staff attempt to drive the animal to an enclosure where it can be temporarily and safely contained? Or is there a better strategy or equipment which will allow a safe recovery of the animal? This should be discussed in advance utilizing “what if” scenarios and/or drills.

Equipment

Beforehand, equipment for emergencies must be identified, located and assigned to designated staff who will bring to the Staging Area. Strategically located “emergency boxes” (Figure 2) may contain: pepper spray and pepper foam, light weight CO₂ fire extinguishers, rope, chain, locks, hand tools, power tools (drill, drill bits, reciprocating saw with metal and wood blades), flares, binoculars, and zoo maps. Ladders should be brought to the Staging Area for possible use in scaling walls, buildings, and moats. Additional fire extinguishers may need to be collected and brought over for observers’ protection. All usable, i.e. protected (enclosed), vehicles should be brought initially to the Staging Area and then dispatched as needed for task forces, observers, moving equipment to desired locations and ferrying visitors to safety or staff to desired locations. It is important that waiting vehicles be parked on the side of roads to allow moving vehicles unimpeded access.



Fig. 2 - An emergency equipment box is pre-staged at strategic locations and contains a variety of equipment that might be needed in an emergency. It should be regularly inspected and inventoried, and the equipment never allowed to be “borrowed”.

Specialized equipment can be useful in certain situations. Night-vision and infrared heat sensing equipment can be extremely useful for night searches; this equipment is available through hunting manufacturers or through the police. Non-lethal weapons are intermediate options that may prevent the necessity of killing the animal; they can serve to re-direct or distract the animal or to temporarily contain the animal. These may include shooting “bean bags,” rubber projectiles, pepper balls, Webshot(tm) nets and other devices. The question of the potential use of the electric dart Taser® gun is frequently raised, but there is little data on its effectiveness beyond humans.

Reviewing the Event

It is important to debrief all staff after drills and especially after real escapes. Within one hour after the conclusion of a real or practice drill, there should be a quick debriefing, which has the primary

purpose of allowing the public relations staff to generate a short statement to the media on the known facts of the escape. This will usually satisfy the press for a short period and allows staff the time to thoroughly investigate the causes and to review the event from all perspectives. You need to give time for area supervisors to debrief their sections and find out what went well and what went wrong. Have every staff member write what they witnessed as well as what they recommend for the future and do it within 24 hours to maintain the "freshness" of events in their minds. If you are a public institution, remind your staff to write only what they know; do not speculate about what they don't know and do not give "opinions." All written statements from government-affiliated or non-private institutions can be accessed by media, lawyers, and others through the federal Freedom of Information Act. Finally, after the conclusion of a critical incident it is very important to quickly administer to the psychological stress and trauma of your staff and volunteers with professional counseling (for information on critical incident stress management, see Fitzgerald et al., this volume).

No later than the next day, assemble area supervisors, designated leaders, department heads, the public relations staff, the directors and anyone who had a significant role to review all facets of the escape. If the event has been tape recorded, it should be transcribed within 1-2 days so that a time-line of significant events can be delineated at the debriefing. Revise your emergency procedures to reflect improvements suggested during the review. For real escapes of dangerous animals it will be helpful to all investigating agencies if a notebook is developed which includes a factual timeline of significant events, statements of any witnesses, a list of staff on duty, photos or diagrams of significant locations, maps, and other relevant information.

"Your Game is Only as Good as Your Practice"

Mandatory practice drills are held quarterly and test out various scenarios (e.g., different animals, "hurt" people) and different situations (e.g., day/night, crowded zoo, during staff lunch hour, etc.). Newly revised procedures are tested in announced "table top" drills where various staff sit around a large map and a drill leader presents them with scenarios and situations to test their response and the adequacy of the revised procedures. Next, this can be advanced to "walk through" drills where each section is presented a scenario on paper and then they calmly examine their surroundings and discuss what they see at that time and what they would do. Finally, a full-scale drill with a staff member playing an escaped animal (or even a domestic goat set loose) allows all staff to practice procedures leading to refinement of procedures and practice for staff. This relatively frequent practice also allows additional staff to assume the various leadership roles. At Dallas Zoo, supervisors, as well as curators, are trained and given the authority to become Emergency Response Team Leaders and Operations Section Chiefs. Veterinary technicians, as well as all veterinarians, are trained as Immobilization Team Leaders. Facility, construction and maintenance supervisors and department heads are trained as Emergency Logistics Team Leaders. Selected individuals are trained as Emergency Weapons Team Leaders. This increases the pool of knowledgeable potential leaders.

The Unified Command System

The Dallas Zoo emergency procedures have evolved further since 2004. While the above procedures for command leadership worked well for several years, and may work well for many zoos, we found that the proliferation of mobile cell phones interfered with the initial command and control of zoo and outside police and fire-rescue forces. If visitors sense any danger or accident, many are inclined to immediately dial 911 rather than contact zoo staff, such that police and/or fire-rescue may be dispatched and arrive at the zoo before zoo staff know an animal has escaped or have a chance to get organized. To prevent disorganization amongst zoo, police, and fire-rescue personnel and questions about command leadership, the Dallas Zoo adopted the Unified Command System (UCS) that police, fire-rescue, and city and county emergency agencies already use to clarify inter-agency command and control. One key aspect to this agreement was that police or fire-rescue would only come to the one zoo entrance closest to the designated Command Post and stage there; they would not enter uncontrolled through multiple other zoo entrances. A second key aspect was that because zoo radios and police/fire-rescue radios operated on different frequencies, any police or fire-rescue officer or team dispatched into the zoo must have a zoo staff member with a zoo radio to provide complete radio communication amongst all attending officers and zoo staff. In addition, the zoo staff can provide advice on zoo geography, resources, and animal knowledge.

Discussion, collaboration, and agreement in advance amongst the different agencies are critical to

making the Unified Command System work. In any unified command the key role is the Incident Commander (IC). The IC is designated in advance, according to procedures dependent upon the situation, and he/she directs the entire operation involving all departments and personnel. At the Dallas Zoo, in the event of a dangerous animal emergency, normally the zoo ERT leader will start out as the IC and direct zoo emergency teams as described above, as well as the initial arriving police patrol officers and fire-rescue personnel. However, as soon as a ranking Dallas Police Department (DPD) Patrol supervisor arrives, the ERT leader will brief him or her, and then when ready, the DPD Patrol supervisor will announce to all in the Command Post and on zoo, police and fire-rescue radio channels that he/she is assuming command as the new IC. The ERT leader must stay present and close to the IC to provide advice on zoo geography, resources, and animal knowledge. A further IC transition occurs when the DPD Tactical Team (SWAT) arrives. Then, the SWAT supervisor is briefed and assumes command from the DPD Patrol supervisor who also stays close by to advise. For a fire on zoo grounds or a rescue from our elevated monorail train, an arriving Dallas Fire-Rescue Department supervisor might take over from the ERT leader or police supervisor as the new IC. The IC has the authority to designate and make search and capture or rescue task forces and deploy them to the proper areas for their assigned task. These teams may be of mixed composition of zoo, police and fire-rescue personnel with a designated team leader. The teams include zoo EWT members and/or DPD SWAT or Patrol officers who have been trained and equipped with their own .458 and .375 rifles. The IC has command of all zoo resources, as well as police officers surrounding the zoo, including the police helicopter (the IC can also command media helicopters to stay away from zoo air space).

Trust is vital to successful inter-agency collaboration. This can only be achieved with understanding of the UCS procedures and the roles of each agency, as well as the familiarity amongst key personnel of the various agencies. This occurs only through substantial discussion, familiarization of police and fire-rescue personnel with zoo staff, and joint training with police, fire-rescue, and zoo staff. Orientation tours of zoo grounds provided for police and fire-rescue officers are also very important. The tours help to build familiarity and camaraderie if zoo keepers and supervisors tour the officers; they can communicate not only their knowledge of animal species and individuals, but also their passion as well. For most police and fire-rescue personnel, it is their first opportunity to get "up close and personal" with dangerous animals and understand the staff's knowledge and commitment. This understanding will allow the separate agencies' personnel to better work cooperatively. In addition to the tours, regular table-top and live action drills allow all agencies to practice working together.

Training has been enhanced for all agencies by sharing knowledge, skills, and resources. The DPD has taken an active role in training the zoo Weapons Team on the police range and in search strategies and techniques. The zoo has purchased and shared the high caliber rifles and ammunition that DPD did not previously have. The zoo also provides classroom training to DPD officers in behavior and anatomy of the zoo's dangerous animals as well as behind-the-scenes tours.

While some have questioned the wisdom of "giving up control" of zoo animal emergencies to the police, the Unified Command System can be a proactive step to prevent any potential confusion over response to an animal emergency which may be initiated by a visitor's mobile cell phone call. At the very least we recommend that all institutions proactively contact their local police or sheriff and fire-rescue departments for a thorough discussion of potential dangerous animal scenarios and what can be expected from each.

Conclusion

Developing the plans, obtaining the equipment, and training the staff to respond appropriately to a dangerous animal escape is a complex endeavor. But the alternative to all the above is, as some zoos have discovered, at the very least, confusion, and at the worst, injurious or fatal to humans and animals. Even though smaller zoos may not have as many resources as larger zoos, the principles are the same. Inventory your resources, develop emergency plans with the resources available, and train regularly. To ensure the safety of our staff and visitors, we must all meet the challenge of emergency preparedness for when the unthinkable happens.

Acknowledgements

Many people have provided valuable input into these procedures, but we would particularly like to acknowledge the following contributors from the Dallas Zoo: Rich Buickerood, Director, Chuck Siegel, Deputy Director for Animal Management, and De McCombs, former Deputy Director for Operations. Similarly, many from the Dallas Police Department have been involved in meshing emergency

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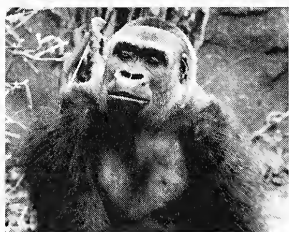
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Dive Safety in Zoos and Aquaria

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Introduction: Developing a Dive Safety program at a Zoo or Aquarium has many facets and is crucial to maintaining individual safety, animal health and limiting liability and potential accidents at an institution. This paper will outline the components of the Monterey Bay Aquarium (MBA) Dive Program that operates within the guidelines set up by the Occupational Safety and Health Administration (OSHA) for diving within the workplace. There is no way to ensure good judgment within each individual in every circumstance, however, if the institutional structure, dive program, training, equipment, and screening process are properly set up and well implemented these individuals are on a path for success and the institution has done due diligence to follow guidelines established to protect its employees and institution. OSHA outlines standards and procedures that must be implemented in the workplace to ensure job safety, including diving. Federal and state OSHA dictate these procedures for diving and every institution is responsible for understanding and implementing these standards as they may vary from state to state. This paper is designed to outline the standards and procedures that have been implemented for running our Dive Safety Program at the time of publishing at the Monterey Bay Aquarium. I have included excerpts directly from MBA, AAUS (American Academy of Underwater Sciences) and ADC (Association of Diving Contractors) manuals as well as OSHA to help illustrate and condense information, however I must stress that this paper is only intended as a guide and not actual standards. The author strongly encourages the reader to consult these standard setting organizations and your organization's liability expert before establishing standards. It is the responsibility of each institution to look at every aspect of the standards put forth by OSHA and other standard setting organizations and evaluate their program from a legally defensible position. Having OSHA determine if your standards are appropriate if an incident occurs is not the right time for that evaluation.

The purpose of Diving Standards is to ensure that all diving is conducted in a manner that will maximize protection of divers from accidental injury and/or illness, and to set forth standards for training and certification that will allow reciprocity between institutions. Additionally, following these time tested code of practices means your institution benefits from years of experience and subscribes to the community standard. The liability of individuals and institutions when working together should be outlined in a legal format and is not implied by an AAUS verification of dive training letter. Fulfillment of these purposes shall be consistent with the furtherance of diving safety.

To begin we must understand that OSHA has set forth standards and guidelines for diving in the workplace in the US. These guidelines are for employees of a business. After much evaluation at a number of facilities the general consensus is, from a legal point of view that volunteers at a zoo or aquarium, although not compensated in money, should be considered employees when designing standards and procedures to satisfy OSHA. Although you may delineate the tasks that you have your staff do vs. volunteers based on their expertise they are most likely viewed as equals in the eyes of OSHA and should be afforded the same level of diligence concerning safety.

The Code of Federal Register 29CFR1910, Subpart T outlines the standards for commercial diving. The law is defined in these final guidelines, supplemental statements and letters of inquiry. OSHA has determined that the standard setting organization for commercial diving is the ADC www.adc-int.org. OSHA has granted exemptions for following these commercial standards if the diving being done is not commercial in nature. Exemptions have been granted to Scientific, Recreational, Public Safety, Governmental organizations and the Military. Each one of these groups petitioned OSHA with a different set of standards that they felt were more appropriate to safeguard the diving they were doing. The key to determine which standards to follow is to look to the definitions for each type of diving that your institution conducts. It is the specific dive, type, nature and purpose

that determine the standards, structure, training, equipment, screening, and individual that is appropriate.

OSHA exempted scientific diving from commercial diving regulations under certain conditions. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). The AAUS www.aaus.org is recognized by OSHA as the scientific diving standard setting organization. Zoos and Aquaria will look to the commercial and/or scientific diving standards as they best fit the practices needed underwater. The decision of which standards to follow rests with the institution as they best understand the dives being conducted. This article will not make this determination as there is some debate as to whether specific tasks are scientific or commercial in nature within zoos and aquaria. However, there are some community practices within these organizations and the dialog that takes place among the profession of Dive Safety Officers at Zoos and Aquaria in organizations like the Association of Dive Program Administrators (ADPA) www.adso.org is probably the best place to gain this knowledge and precedent.

Scientific Diving Definition - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

Scientific Diving Exemption - OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (Appendix B to 29CFR1910 Subpart T):

- a) The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
- b) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- c) The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- d) Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.
- e) In addition, the scientific diving program shall contain at least the following elements (29CFR1910.401):
 - 1. Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; including procedures for emergency care, recompression and evacuation, and the criteria for diver training and certification.
 - 2. Diving control (safety) board, with the majority of its members being active scientific divers, which shall at a minimum have the authority to: approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depths to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for scuba diving.

Review of Standards - As part of each organizational member's annual report, any recommendations for modifications of these standards shall be submitted to the AAUS for consideration.

Dive Program Structure:

Diving Control Board - Setting up and implementing a dive program to enable an efficient and safe operation should be well thought out within the institutional structure to facilitate safety and avoid conflicts of interest. However, the design and departmental alignment, a critical component is the Dive Control (Safety) Board (DCB) which consists of a majority of active divers. This body must have autonomous and absolute authority over the diving programs operation to ensure that the work underwater never supersedes safety. It may be advantageous to have a member who represents the legal team at your institution on this board. This will allow, at a minimum, a group consensus when it comes to decision making, setting standards, approving and monitoring diving projects, reviewing and revising the diving safety manual, assuring compliance with the manual, and taking disciplinary action for unsafe practices. This board will balance institutional liability and dive team safety with the jobs needed to run the facility and always within the confines of the standards that apply to the dive being conducted. Regardless of Scientific or Commercial diving being performed, this board has important legal oversight for the institution. It helps facilitate thoughtful discussion through the diversity of ideas members bring. When safety is involved, the expertise of this group will help trouble shooting and developing procedures for the variety of situations that occur. The autonomy and control of this group is very important in minimizing the potential for conflicting demands on divers and the opportunity for short cuts in the system simply to get the job done quickly, cheaply or incorrectly. Bypassing this element has led to the undermining of safety protocols and unfortunate preventable diving incidents.

Diving Safety Officer -The job of enforcing the standards established by the DCB falls on the Diving Safety Officer (DSO). This person should have broad technical knowledge and experience related to diving. If the dives being conducted are scientific in nature they should have scientific expertise and if the diving is commercial in nature they should possess knowledge in these operations. Among other things that are outlined in the ADC and AAUS standards, this individual will be training divers and supervising all diving operations and so should be an active underwater instructor from an internationally recognized certifying agency. This individual is responsible through the DCB to the administrative officer of the institution for the conduct and safety of the institution's dive program. The daily operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant regulations of the membership organization, rests with the Diving Safety Officer. The DSO may permit portions of this program to be carried out by a qualified delegate, although the Diving Safety Officer may not delegate responsibility for the safe conduct of the local diving program. The DSO should be guided in performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program should be retained by the DSO. In supervising the daily operations it is the responsibility of the DSO to suspend diving operations considered to be unsafe or unwise. This one individual on a daily basis may act as institutional risk manager, dive instructor, equipment repair technician, dive team leader, scientist, accident manager, onsite rescue specialist and hyperbaric medical treatment coordinator. Additionally this person may serve as a volunteer supervisor, collector, boat captain, dive tender, safety diver, tank filler, record keeper, technical diver, fabricator, underwater interpreter. This individual should maintain a high level of up-to-date knowledge and ability in any of the above mentioned job qualifications that are pertinent to the position. This is a very important position for every dive program and its success relies heavily on his/her experience and performance. In some instances an aquarist or animal keeper will act as DSO and in this situation a word of caution is in order. By asking this individual to act in these two capacities it may inadvertently set up a conflict of interests. The pressure to get the job done in a particular way, may force this individual (as an aquarist or keeper) to influence decisions made about the safety of the operation that would violate the standards of diving should be avoided in order to operate within standards.

Dive Manual - The DSO and DCB must develop a Dive Safety Manual as a set of standards or code of practices that the DSO shall apply to daily operations. This manual includes at a minimum: Procedures covering all diving operations specific to the program; including program structure, procedures for emergency care, recompression and evacuation, and the criteria for diver training and certification. If the dives are commercial in nature the manual should also outline a job hazard

analysis (see sample in Appendix 1) for each type of operation that is conducted. This manual should be revised and ratified by the DCB. In the case of Scientific Diving to ensure that the latest standards are being implemented the institution should submit their manual for approval with the AAUS and apply for organizational membership. As a matter of liability and risk management simply having the DCB alone review the manual does not ensure that your institution is in compliance with the latest scientific standards, hence the need for the AAUS to review and approve the manual when policies change. If the diving is commercial in nature then consulting the ADC with questions and guidelines is also appropriate. Both of these organizations, the ADC and AAUS, have manuals available as templates to use when creating your institutional manual and much of the information that is included here is derived from these templates. Again, if OSHA is to evaluate your program after a complaint or incident they will use the latest standards in the industry with regard to the type of diving you are doing so it is wise to seek approval from these standard setting bodies as they are the meter stick by which we will be measured. The bottom line is that these are the latest standards that have been developed for the safety of individuals and team members as well as the ultimate protection of the institution.

Dive Team

The size of the dive team and responsibilities of each individual are determined by the task at hand and a number of other factors. When we are conducting a scientific dive at MBA there is always a lead diver among the team of divers. This lead diver is the onsite coordinator of diving operations. This individual has a number of responsibilities outlined here:

- a) Coordination with other known activities in the vicinity which are likely to interfere with diving operations.
- b) Ensuring all dive team members possess current certification and are qualified for the type of diving operation.
- c) Planning dives in accordance with the Manual
- d) Ensuring safety and emergency equipment is in working order and at the dive site.
- e) Briefing dive team members on:
 - 1. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
 - 2. Modifications to diving or emergency procedures necessitated by the specific diving operation.
 - 3. Suspending diving operations if, in their opinion, conditions are not safe.
 - 4. Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

Each member of the team is responsible for themselves and the other team members with regard to maintaining proper mental and physical health, properly maintained and functioning equipment, current training and knowledge for the specific purpose and environment, ability and knowledge to execute a successful rescue of themselves and team members. Each member should participate in and adhere to the dive plan developed by the team. There is more specific information on dive planning in the current AAUS manual in section 2.20 that should be adhered to. Each team member should additionally understand and be able to carry out the emergency plan developed for their diving environment. A current version of that plan should be kept in the dive manual and regularly reviewed and updated as situations change.



The Utah Chapter AAZK is proud to host the 35th Annual AAZK National Conference in Salt Lake City **September 24-28, 2008**. Here's an exciting preview of what you'll experience in Utah...

Our host hotel, the Salt Lake City Marriott at City Center, is located in the heart of the city's business and cultural district with nearby access to the TRAX light rail system. It is an absolutely beautiful hotel with wonderful facilities and rooms moderately priced at only \$139/night!

Utah is a paradise for outdoor enthusiasts. The pre- and post-conference trips will explore the unique and natural diversity that Utah has to offer. The state's wild beauty ranges from rugged mountains and forests in northern Utah to the colorful landscapes of southern Utah's red rock canyons. The pre-conference trip will explore the diverse ecosystem of the Great Salt Lake while birding at the world-renowned Bear River Migratory Bird Refuge. This trip will also include a lovely autumn drive through the foothills of Logan Canyon to visit the Coyote Depredation Management Research Center, one of the premiere predator research facilities in the world. The post-conference trip will take you to beautiful southern Utah where you will be surrounded by the gorgeous, red rock, desert landscapes near Arches National Park and Moab, Utah.

Our icebreaker will be held on Wednesday, September 24, 2008 at the Discovery Gateway in the heart of The Gateway shopping district. In keeping with our theme of creativity, this premier children's museum will enable you to explore the depths of your imagination with hands-on, interactive exhibits in a fun atmosphere that you won't soon forget!

The conference officially opens on Thursday, September 25, 2008 with a keynote address by one of the finest (and funniest) natural history writers of our time, Dr. Robert Sapolsky, author of *A Primate's Memoir* and *Why Zebras Don't Get Ulcers*. You will hear from a number of other exciting speakers during the week, including Amy Sutherland, author of *Kicked, Bitten and Scratched: Life and Lessons at the World's Premier School for Exotic Animal Trainers*.

And don't forget Zoo Day which will begin early with a "Breakfast with the Birds" at the Tracy Aviary. You'll then head to Utah's Hogle Zoo for a full day of presentations, tours, workshops and fun followed by dinner and the Silent Auction on zoo grounds.

Are you up to the challenge? AAZK Chapters will be receiving information in the mail soon about the 2008 Chapter Challenge and other sponsorship opportunities.

First Call For Papers & Posters

Deadline for abstracts: 1 May 2008

Deadline for papers: 15 July 2008

Our guiding theme for the 2008 conference, "*Elevating Animal Care*", will focus on concepts that highlight **professionalism, creativity** and **initiative** in the realm of conservation, education and animal husbandry. Animal care professionals from all related fields are encouraged to submit high quality, original topics for consideration. Abstracts will be accepted for three presentation types:

◆ **Papers**

Standard papers typically represent a summary of innovative techniques, achievements or approaches to animal care, welfare, conservation, education or research. Authors will be expected to give a 15-minute presentation on the relevance and practical application of their topic.

◆ **Posters**

Accepted posters will be displayed during the conference, therefore the topic should be suitable for visual presentation. Authors will discuss their work with conference delegates during the designated poster presentation session.

◆ **Workshops**

Workshops allow practical presentation and discussion of concepts relevant to animal care professionals. Workshop organizers should outline a list of group leaders, a summary of the theme & significance, format of discussion, expected number of participants and length of workshop.

Abstracts should be no longer than 300 words and should include in detail the significance of the topic being presented along with results, conclusions and benefits of the work described. Poorly written abstracts, those that do not contain proper information or do not otherwise meet submission criteria will not be considered.

All abstracts should include the following information:

- Full name of presenter & co-authors
- Institution/Affiliation
- Position or title
- Title (specify paper, poster or workshop)
- Short bio of yourself for introduction
- A/V needs
- Contact information, including email address

Submit abstract by **1 May 2008** in Microsoft Word via email to utahaazk@hoglezoo.org. Authors will receive an email confirmation upon receipt of their abstract. Authors will then be notified regarding acceptance by 1 June 2008. **All** final and complete papers must be received by 15 July 2008 in order to be included in the program.

For more information, please visit our website www.utahaazk.org

You can also contact us at:

Utah Chapter AAZK
2600 Sunnyside Avenue
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The SCUBA dive team shall adhere to the buddy system of mutual assistance at all times. The buddy system is a diver accompanied by and in continuous contact with another equally equipped diver in the water (AAUS standards). These divers should be comparably trained and equipped to be able to render aid appropriate to the environment, task and situation. Solo diving is not permitted.

When Hookah (air only) or Surface Supply (air and communications) are used to supply the diver with air, the buddy system may be used in a slightly augmented way in order to safely carry out this operation. Both the ADC and AAUS have and are developing new standards that address the specifics that need to be followed to stay within the standards that have been developed to ensure diver safety. The AAUS with help from its Aquarium Organizational Members have adopted a set of standards that dictate specific operations relating to Scientific Aquarium Diving Operations (Appendix 2).

Traditionally, commercial diving operations have a three-person dive team consisting of a working diver, a safety diver / tender and a dive supervisor / leader. These operations are also traditionally accomplished using surface supplied diving mode. There are situations in which two people can fill these responsibilities but certain circumstances must be satisfied. The equipment and procedures for these operations are somewhat different than scientific diving protocols and the ADC / OSHA regulations should be consulted when undertaking these operations. At the MBA we use these and other commercial standards and practices when we are conducting operations that are traditionally commercial in nature such as pipeline inspections and intake screen maintenance and pump inspection.

"Refusal to Dive," In Scientific diving this is a key concept to maintain a safe program. This places the responsibility of diving within his/her limits, experience and ability that day, with the diver. A diver may refuse to dive, without fear of penalty, whenever they feel it is unsafe for them to make the dive. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if they would be violating the precepts of their training or the standards outlined in organization's dive manual. Additionally, this standard empowers divers to use good judgment without the task loading of the job to interfere with critical safety decisions. The safety of the individual and the team must come before the project in all cases. We include this in our commercial diving practices as well as scientific to maintain this high standard of safety.

"Termination of the Dive," It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water. The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional air source at the decompression station. (AAUS) This standard in our manual places a great deal of responsibility on the shoulders of the diver as well as ensuring them that their safety is paramount and they are the ones who can terminate the dive at any time without fear of retribution if they feel it is unsafe.

Training and Certifications:

A big part in a positive outcome if a diving accident/ incident occurs in a program is the training that the individuals received upon entry, and continue to receive to maintain current status. During a dive incident it is proven that under stressful situations individuals rely on their training and available equipment to deal with the situation. So, your best defense is a good offense of appropriate training and continued retraining on a regular basis to maintain proficiency. The program is only as strong as the weakest link so it goes without saying that shortcutting training even with one individual could result in tragedy for others relying on them.

Divers at Zoos and Aquariums meet standards for training of 100 hours (scientific), and specific job training (commercial). Traditionally training in scientific diving and commercial diving focuses more on either the scientific methodology or technical and advanced diving operations (i.e. saturation diving for commercial operations). Graduates of these programs may not be ideally suited to conduct some operations at zoos and aquaria. Most aquariums and zoos focus those 100 hours of training on safety, techniques of husbandry, feeding, species identification and animal health. And while some organizations do conduct traditional (semester long) scientific diving courses, it may

not be feasible to run these at your facility. Training requirements for each of these standard-setting organizations are detailed in their standards and codes of practices and should be thoroughly evaluated when developing a program that works for each institution.

The majority of the diving operations that are conducted by the Monterey Bay Aquarium are scientific in nature and as such are done under the auspices of the AAUS. We require that all of our divers, both staff and volunteers, must be trained up through Rescue through a recreational SCUBA training agency and stay current in CPR, First Aid for diving accidents and Oxygen administration. This prerequisite along with specific supplemental training, a written exam, medical screening (Section 6 AAUS manual and Appendices 1 through 4), equipment inspection and check-out dive (Section 4.2 AAUS Manual) will satisfy the AAUS 100 hours minimum theoretical and practical training (Section 5.3 AAUS Manual) to be certified as a Scientific Diver, if successfully completed. This certification is only valid if the individual maintains current training required by our institution and is diving under our auspices.

In order to maintain current certification, individuals must remain active as divers conducting at least 12 dives over 12 months without any period of inactivity exceeding six months. Each diver will submit their equipment to inspection that meets requirements in the equipment section of the AAUS and MBA manuals. Divers must submit logs to verify activity and ensure current depth certification. As there are specific challenges, training and equipment that are appropriate to diving to greater depths, it is important to maintain information that will keep records of these depth certifications for each individual. We maintain most of our divers at a 60 max depth current certification and for those few that have the need to venture deeper, we have specific training regiment that they must go through with the DSO and requirements for maintaining this more advanced level of certification. For specifics on Depth certifications see section 5.4 of the AAUS Manual.

When training to accomplish the diving that is commercial in nature your institution should follow guidelines set up by ADC. Entry-level Commercial divers shall possess the necessary qualifications for the job assignment. Divers need knowledge and skills gained through a combination of formal training and/or experience in the following: Diving procedures and techniques, emergency procedures, physiology and physics (diving-related), diving equipment, first-aid and CPR, electronics, computer technology, hydraulics, mechanics. These individuals must obtain a minimum of 317 hours of formal training in fields related to above topics to obtain entry level certification. The ADC has specifically stated that persons only trained in the traditional recreational field are not suited to conduct commercial dives without specific formal training. (ADC Consensus Standards for Commercial Diving Operations Manual). If the diving at your institution is commercial in nature it is your responsibility to train divers and conduct dives in accordance with the ADC standards.

Equipment:

All equipment should meet standards as determined by the Diving Control Board and the Diving Safety Officer. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance.

Standards for appropriate operational and rescue equipment for the job are clearly outlined in both the Scientific and Commercial diving manuals. The specific manufacturers and models are up to the DCB and Dive Officer to approve for use, testing and evaluation. This again is where an experienced DSO who is trained in equipment maintenance and evaluation is invaluable to keep the operation running smoothly.

Equipment Record Keeping - Each equipment modification, repair, test, calibration, or maintenance service shall be logged, including the date and nature of work performed, serial number of the item, and the name of the person performing the work for the following equipment: Regulators, Submersible pressure gauges, Depth gauges, Scuba cylinders, Cylinder valves, Diving helmets, Submersible breathing masks, Compressors, Gas control panels, Air storage cylinders, Air filtration systems, Analytical instruments, Buoyancy control devices, and Dry suits.

Medical Evaluation:

The institution should determine that divers have passed a current diving physical examination and

have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report. All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine. At MBA we choose to pay for our volunteer divers as well as staff so we can ensure that the doctor doing the evaluations understands our organizations diving standards. By having one primary Dive Physician that we send our divers to we have streamlined our program to be very consistent. Additionally, we have chosen our DMO (Diving Medical Officer) for his expertise in Hyperbaric / Diving Medicine as he is a DAN Certified Diving Physician. With patient privacy laws as they are, it is very important to ensure that you work closely with your doctor to determine an appropriate record keeping protocol. It is important for the DSO and DCB to work closely with the DMO to ensure an understanding of particular situations that could potentially put the dive program and other dive team members in jeopardy when it comes to a host of medical concerns, such as communicable diseases. As there is always the possibility that any individual may need to rescue another so is the importance of personal protection, disinfection of common equipment is crucial in protecting all individuals from preventable disease transmission.

Medical evaluation shall be completed at a minimum:

- 1) Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years (3 years if over the age of 40, 2 years if over the age of 60), the member organization has obtained the results of that examination, and those results have been reviewed and found satisfactory by the member organization.
- 2) Thereafter, at 5-year intervals up to age 40, every 3 years after the age of 40, and every 2 years after the age of 60.
- 3) Clearance to return to diving must be obtained from a physician following any major injury or illness, or any condition requiring hospital care. If the injury or illness is pressure-related, then the clearance to return to diving must come from a physician trained in diving medicine.

These frequencies or evaluation were determined by AAUS through discussion and a medical panel workshop. It is up to your DCB and DMO to determine if these minimums should be increased according to variables at your institution such as age of staff and volunteers, strenuousness of tasks, etc. Any institution can exceed standards for scientific diving, but you must maintain the minimums set up by AAUS. At the MBA we increase the frequency of dive evaluations at advanced age on advice from our DMO due to our population of volunteer and staff divers. Our dive team which conducts dives that are more commercial in nature have dive physicals annually as prescribed by ADC standards.

The specifics of the AAUS Dive physical are listed in Section 6 and Appendices 1 – 3 of the most current AAUS Manual). It is wise to develop medical forms that satisfy the medical history and test format that are standardized and approved by the DCB as well as any other legal entity at the institution. After any medical examination relating to the individual's fitness to dive, the organizational member shall obtain a written report prepared by the examining physician. It shall contain the examining physician's opinion of the individual's fitness to dive, including any recommended restrictions or limitations.

Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the Diving Control Board and the standard setting organization (AAUS or ADC) as well as the appropriate labor organization, the Divers Alert Network (DAN) and any training agency that you may be using if training is taking place. The report will specify the circumstances of the incident and the extent of any injuries or illnesses to allow for prevention of further incidence and must meet appropriate requirements. The incident should be fully investigated by the DCB and may be investigated by these other organizations to assess program safety and negligence

Operational Procedures

Once the basics of the program have been set up the general procedures can be used as a template for the DSO and DCB to apply to various situations. There is a system and set of guidelines in place to facilitate operating within these guidelines. In the case where atypical situations occur, or as typical procedures become very complex, the DSO working with the DCB will create new protocols. These situations should be clearly communicated to the dive team in the form of memorandum or even an appendix to the dive manual. An example of this comes to mind as we at MBA developed a set of diving protocols for Skin divers that would be diving in the open ocean to rehabilitate southern sea otters (*Enhydra lutris nereis*). Because of the nature of the animals, environmental conditions and the fact that Skin diving training and procedures are not well outlined in the AAUS manual, we added an appendix to our manual specifically for this program. We looked at consensual standards in the industry for Skin diving training and overlaid these with the dive standards for scuba and came up with a good set of protocols that suited our needs, as well as the researcher's needs, while abiding by our standards and approved by our DCB.

Conclusion

Diving is one of many facets of most large and small Zoos and Aquaria in the US. As with other operational components there is no room for error in most instances. The consequences of possible errors or dive issues as with animal handling and rearing can mean life or death of animals and/or staff, institutional issues, law suits, educational fiascos and public relations disasters. However, a safe, productive and proactive dive program has yielded some of the most progressive interactive guest experiences yet, breakthroughs in animal handling and husbandry, easier management of feeding and supplements in community exhibits, volunteer opportunities to connect with the local community, programs that can collaborate with universities on underwater research programs at the AAUS level, and so much more. Through this paper I have tried to demonstrate the importance in spending time, resources and support of a strong safe dive program by illustrating the need to understand and follow the standards that have been set out for us by years of experience in this field. The information in this paper has been shared freely among institutions and DSO's around the country for which I am deeply appreciative. As with all of our scientific endeavors, it is this body of research and knowledge that we should learn from and build on to further diving safety at all of our institutions.

Acknowledgments - I wish to thank and appreciate the Dive Office staff at the Monterey Bay Aquarium George Peterson and Brianne Berlin for their tireless efforts to create a safe, educational and fun environment in all of our dive programs. Additionally, I want to thank a great mentor, friend and Dive Safety Officer Gavin Wuttken whom I have learned so much from over the years. Lastly, thanks to Jon Hoech, my boss, for his guidance and friendship.

Appendix 1: Job Hazard Analysis (ADC Manual)

JOB HAZARD ANALYSIS				
Company:	Location:	Date:	Page 1 of 1	New Revised
Job or task:				
Basic Job steps	POTENTIAL HAZARDS	Recommended safe procedures		
Prepared by:		Reviewed by:	Approved by:	

Appendix 2: Aquarium Diving Operations (AAUS Manual Section 8)

General Policy: Section 8.00 applies to scientific aquarium divers only.

Definition - A scientific aquarium diver is a scientific diver who is diving solely within an aquarium. An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research.

It is recognized that within scientific aquarium diving there are environments and equipment that fall outside the scope of those addressed in this standard. In those circumstances it is the responsibility of the organizational member's Dive Control Board to establish the requirements and protocol under which diving will be safely conducted.

Note: All of the standards set forth in other sections of this standard shall apply, except as otherwise provided in this section.

The Buddy System in Scientific Aquarium Diving - All scuba diving activities in the confined environment of an aquarium shall be conducted in accordance with the buddy system, whereby both divers, or a diver and a tender as provided below, are always in visual contact with one another, can always communicate with one another, and can always render prompt and effective assistance either in response to an emergency or to prevent an emergency.

A diver and tender comprise a buddy team in the confined environment of an aquarium only when the maximum depth does not exceed 30 feet, and there are no overhead obstructions or entanglement hazards for the diver, and the tender is equipped, ready and able to conduct or direct a prompt and effective in-water retrieval of the diver at all times during the dive.

Diving Equipment

Section 3.20 AAUS manual is modified to read as follows:

In an aquarium of a known maximum obtainable depth:

- 1) A depth indicator is not required, except that a repetitive diver shall use the same computer used on any prior dive.
- 2) Only one buddy must be equipped with a timing device.
- 3) The maximum obtainable depth of the aquarium shall be used as the diving depth.

Scientific Aquarium Diver Certification

A Scientific Aquarium Diver is a certification enabling the qualified diver to participate in scientific diving in accordance with Section 8.00 as provided below. All of the standards set forth in sections 4.0 and 5.0 of this standard shall apply, except that Section 5.30 of this standard is modified to read as follows: Practical training shall include at least 12 supervised aquarium dives for a cumulative bottom time of 6 hours. No more than 3 of these dives shall be made in 1 day.

Scientific Aquarium Diving Using Other Diving Technology

Surface Supplied Scientific Aquarium Diving: *Definition:* For purposes of scientific aquarium diving, surface supplied diving is described as a mode of diving using open circuit, surface supplied compressed gas which is provided to the diver at the dive location and may or may not include voice communication with the surface tender. Divers using the surface supplied mode shall be equipped with a diver-carried independent reserve breathing gas supply.

Scientific aquarium divers using conventional scuba masks, full-face masks, or non-lockdown type helmets are exempt from this standard provided:

- 1) There are no overhead obstructions or entanglements.
- 2) The diver is proficient in performing a Controlled Emergency Swimming Ascent from at least as deep as the maximum depth of the aquarium.
- 3) The diver is proficient in performing out of air emergency drills, including ascent and mask/helmet removal.
- 4) Each surface supplied diver shall be hose-tended by a separate dive team member while in the water. Scientific aquarium divers are exempt from this standard, provided the tender is monitoring only one air source, there is mutual assistance between divers and there are no overhead obstructions or entanglements.

Divers using the surface supplied mode shall maintain communication with the surface tender. The surface supplied breathing gas supply (volume and intermediate pressure) shall be sufficient to support all surface supplied divers in the water for the duration of the planned dive.

- 1) During surface supplied diving operations when only one diver is in the water, there must be a standby diver in attendance at the dive location. Scientific aquarium divers are exempt from this standard, provided the tender is equipped, ready and able to conduct a prompt and effective in-water retrieval of the diver at all times during the dive.”
- 2) Surface supplied equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- 3) All surface supplied applications used for scientific aquarium diving shall have a non-return valve at the attachment point between helmet or mask hose, which shall close readily and positively.

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“Wildfire!” One Facility’s Response and Lessons Learned

*By Chuck Brinkman IV – Professor, Moorpark College
The Staff at America’s Teaching Zoo
The Students from the Class of 2004 and 2005
Moorpark, CA*

Abstract

In late October 2003, America’s Teaching Zoo at Moorpark College, was threatened by a Southern California wildfire. The five-acre facility, housing almost 200 different animals representing over 100 species, was faced with evacuating as many animals as possible in a very short amount of time without a contingency plan to deal with this sort of event. As fire approached on three sides of the facility, the staff and students had some difficult decisions to make - which animals could safely be prepared for transport, and where to relocate the animals after evacuation. The staff finally evacuated all personnel from the facility, but quite a few animals were left behind. After the smoke cleared, the facility and all personnel had survived the fire, but several animals were not as lucky. This ‘Trial by Fire’ resulted in the immediate revision and drafting of a new “Emergency Plan”.

This paper will give a brief chronology of the fire, and then outline and discuss some of the lessons learned: emergency preparedness, training, staff, animal and facility safety, efficient use of personnel, supplies and other resources, and finally what must be done after the crisis is over. Using this case study as an example, it is hoped that other facilities will realize the need for an emergency plan to address fire and other crisis events, and adapt the plan developed at America’s Teaching Zoo to fit their needs.

Introduction

In 2003, from Friday 24 October thru Thursday 30 October, America’s Teaching Zoo at Moorpark College – home of the Exotic Animal Training and Management Program (EATM) - was threatened by the Simi Valley Fire. This fire ultimately burned for 11 days and scorched over 108,000 acres.

The five-acre facility of America’s Teaching Zoo houses almost 200 different animals representing over 100 different species, both exotic and domestic, endangered and common animals, large carnivores, primates, birds, reptiles, hoofstock, and one marine mammal. America’s Teaching Zoo serves as the “hands-on” laboratory for the EATM Program, which has six full-time faculty/staff members. Staff consists of professors who teach most of the courses, a full-time veterinarian, two full-time zoo operations staff, and several part-time faculty and staff. There are 100 students enrolled in the two-year program at the College - 50 students in their first year, and 50 students in their second year of the program.

Brief Fire Chronology

The fire started Friday 24 October over by Six Flags Magic Mountain in Valencia, near the junction of the 126 and 5 freeways. Pushed by hot Santa Ana winds from the east, the fire burned through the brush near the town of Piru, and into the hills east and south of Fillmore. This starting point is tens of miles away from America’s Teaching Zoo. The fire grew in size and intensity throughout Friday as it consumed the brush in Southern California hills that had not been burned in almost 20 years. The fire was being pushed to the west – toward Moorpark and Simi Valley.

By Saturday morning, 25. October, there was already a great deal of smoke in the air at Moorpark College. The day got smokier and the sky turned orange from all the smoke. Ash started coming down later in the day. The air quality got progressively worse as the day went on. By about 1400hrs there was smoke, but the fire was still a long ways off, to the northeast of the college. Preparations were still being made to hold the football game Saturday evening in the stadium at Moorpark College. No one thought or knew the fire would come this way, or this far. But by 1500hrs, the fire was

definitely heading for the Moorpark area. It crested the hills several miles to the north of Moorpark College, and started to burn its way down toward the campus and community. By 1600hrs the smoke obscured the sun as the only staff member on duty that day was making preparations to close down the zoo for the night. There were only a handful (about eight or so) first-year students on zoo grounds, doing closing rounds for the evening. With the hot Santa Ana wind also blowing, there had only been about ten zoo guests all day.



Smoke starts coming over the hill towards Moorpark...

As students and staff finished closing rounds Saturday afternoon, they realized the fire was getting closer, and headed toward the zoo. The staff member on duty designated a student to sit at the phone, and call all EATM staff – to alert them to the situation. Crates were hastily assembled on the lawn in front of the main office, mostly with zip ties. Knowing that birds are particularly susceptible to the air quality, which was rapidly deteriorating due to the smoke, the staff member on duty directed the students try to catch and crate most of the birds (mainly

psittacines and raptors). Most are conditioned to handling and could be easily caught. Students were called in, especially students who had large trucks, that could be used for hauling crates. After many of the birds were caught, the smaller, more easily manageable other animals began to be caught and crated. Finally, just about any animal that could be caught up was loaded into crates. As trucks were filled with crates, the students were sent down to a nearby the parking lot of a strip-mall about two miles away. Several students remained there with the animals (in crates both in the trucks, and spread out on the ground) while other students went back for another load of crates and animals.

Because the police had set up roadblocks in the area, students coming in had to talk their way through these roadblocks. For the most part, the police were very good about letting the students through.

Another staff member arrived and proceeded to catch the last remaining birds of prey. A third staff member arrived at about 1730hrs and proceeded to help with the captures. All available trucks, SUV's and vans were loaded and sent to the local strip-mall with one of the staff members. It was then decided to go instead to the Target® shopping center parking lot in Moorpark – a bigger, more wide open space, a bit further away, and perhaps a bit safer area also. The Zoo Operations Manager arrived just as everyone was leaving with most of the smaller animals. As the zoo was evacuated, the potentially dangerous animals (larger primates, tiger, lion, hyena and others), and the larger animals for which there was no means of transport (camels, water buffalo and more) were left locked in their enclosures or night quarters. The fire department had come by, telling everyone to evacuate, saying “we will not be responsible for your lives if you stay”.

During this time the second-year students were on a week-long Northern California field trip with one of the EATM faculty members. On Saturday morning, the groups were still up in Monterey. Saturday afternoon (the last day of the field-trip) was spent driving to their final destination. They arrived and stopped at Zoo-To-You (an animal outreach facility), late on Saturday afternoon. The second-year students did not hear about the fire until they reached Zoo-To-You in Paso Robles, about 1600hrs. Upon hearing the news, a decision was made to return immediately to America's Teaching Zoo. They all spent a tense 3+ hours during the drive back to Moorpark. The group was

accompanied by the owners of Zoo-to-You, with both of their big vans and an animal trailer, to be used as needed.

The three staff members left in Moorpark and the first-year students who had evacuated about half the animals to the Target® parking lot, spent the remainder of the late afternoon/evening at Target®. Sometime about 2000hrs, the vans carrying the second-year students finally arrived after driving down from San Luis Obispo. Cell phones come in really handy during an emergency. Everyone stayed in constant contact during the ride back to Moorpark.

Saturday evening, the most of the crated birds were taken to a facility 30 miles away outside the smoke zone. The reptiles and some other small mam-mals were temporarily relocated there also.



Getting crates ready to use...

The newly arrived second-year students and staff re-loaded the crates into the six, 15-passenger vans and went back to the zoo to collect more animals. While the flames came closer, students and staff worked to crate many of the remaining animals and also wet down the facility as much as possible.



Looking back toward Moorpark College from the Target® parking lot...

It looked like everyone would need to evacuate again, but the fire passed down both sides of the college campus.... and even burned onto the far side of the campus for a brief time. The electricity went out intermittently during this time, and there were few flashlights – not enough for everyone. Students and staff all stayed at the facility, with crates loaded into vans and trucks, ready to go if necessary. The fire burned all around the college Saturday night and into Sunday morning.

Saturday Night - EVERYTHING all around the college was on fire. No

houses or structures were lost on campus or in the immediately surrounding neighborhood, but the campus was really the only island of green on a sea of burned hills. It was very lucky that the dry hillside on the east side of the zoo facility did not catch fire – that would have channeled the fire right into zoo grounds. Every single hill you could see from the zoo turned black. It is estimated that during Saturday evening/night – the fire was burning over 1000 acres an hour. It was big, and consuming everything in its path.

By Sunday mid-morning, 26 October, the fire was mostly gone from the college area. The animals were left in crates in the vehicles just in case evacuation became necessary. Students stayed with them, running the air conditioning in the vehicle to cool the animals down as needed, and checking them every hour. There were many hot-spots, and flames would occasionally flare up in the surrounding hills as more brush catch fire.

By Sunday evening, most of the nearby hot-spots were out. The power came back on again (it had been going off and on since Saturday afternoon). By late Sunday evening most of the animals were returned to their enclosures, after more than a day in the crates. The reptiles and other small mammals returned from their evacuation center about 2100hrs on Sunday, and were returned to their exhibits. The birds remained evacuated for several more days due to the poor air quality in the Moorpark area. They eventually returned Thursday, 30 October.



Fire approaching the crest of the hills (helicopter flying overhead)

Only two animals died during this ordeal, an arctic fox (*Alopex lagopus*) and a Noble Macaw (*Ara nobilis cumanensis*). Both appeared to be stress-related deaths. Given the scope of this wildfire, it could have been much worse.

Moorpark College remained closed all of Monday and Tuesday, 27 and 28 October with classes resuming on Wednesday 29 October.

Deaths/fire-related

Tango - Arctic Fox

Sunday afternoon,

26 October, after the worst of the fire had passed, Tango, the arctic fox, was observed to be lethargic in his crate. He was moved to an air-conditioned classroom. Veterinarian Dr. Peddie concluded that he appeared to be overheated. Dr Peddie took his temperature... it was almost 108°F. Immediate action was taken to cool the little guy... ice bottles, ice water, alcohol, and IV solution was used. Tango's temperature did slowly come down... but apparently the heat, stress, and other contributing factors were too much. About three hours later, Tango went into convulsions, and finally went into atrial fibrillation. That was our first loss...

Kermit - Noble Macaw

Kermit, the noble macaw, was found dead in his enclosure at the bird evacuation site 30 miles away on Wednesday 29 October.

Exact cause of death unknown, but presumably fire/stress related.

Survivors

175+ Animals at America's Teaching Zoo

97 Students

10 Staff members

Lessons Learned, and Incorporated into the New Contingency Plan

This emergency situation shows the need for a comprehensive disaster plan – whether for fire, earthquake or other type of catastrophe. In the ensuing weeks, a concentrated effort was made to develop a written plan that could be adapted to most types of emergencies. Here are a few of the lessons learned from the fire at America's Teaching Zoo.

Make a pre-plan now!! Do not wait until the emergency is at your door. You must plan for the small situations, but do not forget to plan for the LARGE emergencies as well.

- 1 – Husbandry Training – train crate behaviors on as many animals as possible.
- 2 – Have adequate crating and transport on hand for the entire collection.
- 3 – In an emergency situation, designate an onsite Evacuation Coordinator as the person in charge. All issues, concerns, problems should go through this person, so they are aware of the big picture. This person should remain near the office or front of the facility, and be in constant radio contact if needed.
- 4 – Have plans in place where (and how) to relocate any/all animals that will be evacuated from the facility.
- 5 – Designate an off-site evacuation meeting place and designate one person to take charge of this site. All issues, concerns, problems should go through this person while at this location.
- 6 – Make the facility as fire-resistant as possible - plant fire-resistant shrubs/trees, keep facility clear of flammable debris accumulation. Large pine, fir and eucalyptus trees are very flammable, and should be replaced or pruned to keep them in check.

Other Extremely Important Points

During a major wildfire, the fire department and other resources will be stretched very thin. Do not count on outside agencies for assistance. Be self-sufficient.

- 1 – Keep an up-to-date phone list of emergency contact numbers available. Have a “calling-tree” system in place for emergencies.
- 2 – Make efficient use of personnel. Many former graduates of the EATM program and other volunteers from the local community arrived to help. It is helpful to have a means to easily identify these volunteers – give them some type of badges to wear so they can be identified. It was also helpful to restrict these volunteers to the front area of the zoo, so they could be evacuated as needed, if or when the situation became necessary.
- 3 – Police will often set up roadblocks, and prevent EVERYONE from entering the fire area. This may make it difficult or impossible for staff to reach the facility. It is best to have several contingency plans to address this concern.
- 4 – During a fire or other emergency the power, water, and phones may be out, or be unreliable. Cell phones may be working, but it is also prudent to have a supply of portable radios for staff to use. And a way to recharge these radios – extra batteries are important.
- 5 – Create a defensible space around structures.
- 6 – Park vehicles **headed out** for a quick get-away if needed. Leave keys in the ignition. Keep windows closed so sparks/embers do not get inside.

Finally

Realize what might happen days or months into the future due to the fire. The lack of cover on the hillsides produced record rain runoff in the following rainy season – be aware that without brush, grass or other plants to slow down or absorb the rain, mudslides are common after fires. The ground will not absorb as much rainwater after a fire. The facility should make plans for this possibility.

A week after the fire, students and staff had a debriefing. Here are some guidelines that came out of this meeting:

Fire Response Feedback - Lessons Learned at America's Teaching Zoo, Moorpark College

1. First rule in any emergency - Stay calm and safe. Don't create another emergency.
2. Evacuation should be coordinated so that you get the greatest number of animals out.
 - a. Recognize it is extremely likely that the animals will not be acting normally due to the fire, confusion, middle of the night etc.
 - b. Crate smaller/least dangerous animals first
 - c. Make sure that students (or volunteers) know they must be specifically directed in animal-related interactions
 - i. Students did use good technique applying what they had previously seen done, but don't have the experience yet to make the necessary judgment calls about what is safe to attempt, and what is not.
3. Students need to recognize that an animal out on leash is a different animal during a fire or other emergency.
4. Understand the need for fresh reserves when it is a prolonged emergency. Go home when asked to so you can get rest and be ready to do another shift if necessary. Be rested so you can assist to your full potential.
5. Some things Staff learned in addition to having a written fire protocol:
 - a. We need emergency boxes with emergency equipment in several locations throughout the zoo. Emergency boxes to include:
 - i. Gloves
 - ii. Extra leashes/collars
 - iii. Volunteer badges - so any volunteers can be easily identified
 - iv. Flashlights/batteries
 - v. etc
 - b. Be more careful with non-staff/student volunteers
 - vi. Give more specific directions
 - vii. Keep non-staff volunteers assisting at the front of the zoo
 - viii. Use volunteer badges to identify them
 - b. Put together an evacuation plan for each area
 - c. Label crates so that they are used efficiently... (i.e., small crates for small animals so you have large crates left for larger animals)
 - d. Coordinate with Maintenance and Operations Departments so that we have access to vehicles for evacuation.

(All photos provided by the author)

Keep Communication Equipment Powered in an Emergency, Part 1

What to put in your emergency power kit

By: Thomas Shaddack

November 9, 2005

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There's no doubt that high-tech communications equipment is increasingly playing a vital role in disaster relief efforts. In the aftermath of Hurricane Katrina, displaced residents from New Orleans and other affected regions relied on ad-hoc Internet kiosks to connect with loved ones and find housing outside the disaster zone, while relief workers used cell phone calls, SMS messages, and e-mails to coordinate efforts.

But keeping all that equipment powered up in the midst of a crisis, when the electric power grid is likely to fail, is no easy task. Even organizations that have uninterrupted power supplies (UPSs) and backup generators can find themselves in a bind when the lights go out. After all, UPSs only keep equipment powered long enough to get past brief power outages, and gas-powered generators have their own issues, like noise and ventilation requirements.

One option is to supplement backup solutions like these with an emergency power kit. At the least, the kit should contain basic electrical doodads, like cables and batteries, that are so hard to find once a disaster actually strikes. Depending on how critical communications equipment is to your organization's mission, you may also want to stock your kit with enough electrical components so that, in a dire situation, you could splice together a connection between just about any battery and the power input jack on your router, Wi-Fi base station, or other communications device.

Preparing an Emergency Power Kit

Since different organizations will have different needs, we've separated the emergency power kit into two sections: must-have supplies, and advanced supplies. The must-haves should help you cope with most power outages. The advanced supplies are handy for situations in which your power sources are limited yet you absolutely have to get some critical device powered up. In the second part to this series, I'll show you how to use the advanced supplies to connect just about any battery to any communications device.

Checklist:

Must-Have Supplies

1. Specialty batteries
2. High-power batteries
3. Specialty chargers
4. Power inverter
5. Cables
6. Manuals
7. Laptop computer
8. Alternate communications devices
9. Standard tool set
10. Duct tape
11. Permanent markers

Advanced Supplies

1. Power connectors
2. Battery clamps
3. Voltage regulators
4. Capacitors
5. Heatsinks
6. Resettable fuses
7. Transils
8. Diodes
9. LED diodes
10. Multimeter
11. Voltmeters
12. Propane torch, with soldering tip
13. Hot glue sticks

Must-Have Supplies

The supplies on this list should make most power outages easier to deal with.

Specialty batteries. Most people remember to stock up on standard batteries for emergency flashlights and radios, but it's important not to forget the specialty batteries that fit into your organization's cell phones, laptops, and other devices. These batteries are hard to recharge or replace in the midst of emergencies.

Don't forget that batteries lose charge over time. If you get advance warning of a disaster, such as an oncoming hurricane, it's a good idea to make sure your specialty batteries are fully charged.

High-power batteries. The standard A-, C-, or D-cell batteries you put in your flashlight don't have a lot of power. So if you think you're going to need to keep a lot of communications devices running for hours on end without the help of a gas-powered generator, it's a good idea to keep some lead-acid batteries with your kit.

The lead-acid battery that most people are familiar with and have easy access to is the standard 12V car battery. These are designed to provide a lot of power in short spurts, mainly to start a car engine. They're good if it's all you have access to, but they may not survive if you keep using them up and recharging them multiple times.

A better option is to get a deep-cycle battery, which is designed to provide a steady current over a long period of time.

Specialty chargers. If you're lucky, you may get a chance to recharge your specialty batteries by plugging a charger into a gas-powered generator or into an electrical outlet that's connected to a working section of the electrical power grid. Don't miss out when an opportunity like this pops up: have your specialty chargers ready.

Also, check whether you can get specialty chargers that plug into the cigarette lighter socket in an automobile. These are definitely available for cell phones and will make charging up very easy.

Cables. If you do get access to a gas-powered generator during an emergency, it may be set up outside for ventilation purposes. Extension cords will let you power your equipment where you need it most.

Don't forget other networking cables, too. In an emergency, you may have to reconfigure networks on the fly. Stock extra Ethernet patch cables, a spool of CAT5e, RJ45 connectors, and the tool for affixing them. Also, don't forget a separate Ethernet crossover cable which you might need to connect a laptop directly to the network equipment if the equipment has no MDI/MDI-X autosensing feature. (It's best not to count on it).

Finally, note that CAT5 cable is especially handy. When you connect two pairs together, it can be used as a short-haul power cable for the battery. (But you can't use it for too long of a distance and too high of a current, though, as the wires are rather thin and you would lose voltage on their resistance). You can also use it as a telephone cable, for audio signal. Or you could pull the individual wires from it and use them as short patching wires or even to tie things together.

Power inverter. When the electrical grid goes offline, an inverter provides the easiest way to power up devices that don't normally use batteries, like Wi-Fi base stations and routers. The inverter is a device that plugs into a car battery on one side and has a standard electrical plug on the other side. You can this plug to connect and power any device with a low enough power rating. (Using an inverter, you could run a 110 V-powered TV from a car battery.)

Laptop computer. Once you get, say, a Wi-Fi base station powered up, you'll want to connect to it with a laptop to configure the station's settings and prepare it for use. You can usually do this with an Ethernet cable, though having a Wi-Fi card in the laptop may be more convenient for configuring multiple devices.

You will also want to pre-load the laptop with network analyzing software (like tcpdump or ethereal) and Wi-Fi analyzer software (like Kismet or Netstumbler) to be able to see what devices are nearby, what devices talk with which ones, and what channels are available to claim. Get some experience with these tools before an emergency happens. The ability to see network activity is essential for finding flaws quickly.

Manuals. Unless the configuration interfaces for your devices are incredibly intuitive, you're going to need the manuals for those devices. The manuals should contain the default passwords for the devices so you can access them once they've been reset.

It is also strongly advisable to write important information, like the access passwords and MAC addresses, in the manuals or on the devices themselves. This goes against the spirit of access control in a conventional setting, however in a crisis it is more important to have immediate access instead of losing valuable time. Less permanent information like the configured IP addresses can be written on post-it notes or a piece of tape attached to the given device or manual.

Keep in mind that some wireless access points have two MACs, one for the wireless side and one for the Ethernet side. Write both addresses on the cases.

A somewhat compromised option for equipment used both in crises and in "peacetime" is to write the more sensitive information on the inner side of the equipment cases, depending on the tradeoff between need for security and the need for quick access when disaster strikes.

Alternate communications devices. As you rush to put together a Wi-Fi base station or some other high-tech communications device, you'll need some means for your team to stay in touch. This may range from two cans and a string — which I used between two buildings as an ad-hoc intercom and which can be surprisingly practical where the geometry of the situation allows it — to satellite phones, depending on your teams preferences, budget, and goals.

Small handheld transceivers are a practical solution, but depend on batteries. Low-tech options include: using Morse code with a whistle, sign language with optional binoculars, or any variant of flag signaling. (Former Boy Scouts should have an advantage here.)

Standard tool set. You want to make sure you've got the tools to disassemble and reassemble all the equipment you have on site. That includes combination pliers, wire cutters, and screwdrivers. You never know when you will have to get inside something. If your equipment uses screws with non-standard heads, replacing them with the standardized flat screws or Philips ones is strongly advised. Do not forget a screwdriver with a long thin shaft, which can reach screws "conveniently" located in obscure distant parts of the equipment; such a surprise can ruin your day otherwise.

Duct tape. Duct tape holds the world together. It can be handy for putting covers back on devices without screws, or for labeling equipment, among other things. Don't underestimate the amount you'll need, as you can have too little but never too much.

Colored electrical PVC tape can be handy, too, to quickly and easily distinguish which cables belong to which devices. This also allows for easy directives for your crew, along the lines that red-marked devices are mission critical while green-marked ones are fair game and can be cannibalized to keep the red ones running.

Permanent markers. Human memory tends to be imperfect, especially under stress and fatigue, and it's not advisable to assume the rest of your team knows exactly what you are doing. If you can mark cables, devices, and other items with notes and instructions, you've got a better chance of running a successful operation.

Advanced Supplies.

In an emergency where you can't plug the standard power adapters that come with the devices into

the electrical power grid, you may have to improvise by splicing together electrical components to create your own custom adapter that draws power from a battery.

Most of these electrical components on this list are available at your local electronics supply store, like Fry's or Radio Shack. Though you don't have to know exactly how each component works, we highly recommend that you familiarize yourself with the following components and circuits in "peace time" so that you're more efficient at using them during an emergency.

Power connectors. If you have to build a custom power adapter that draws its juice from a battery, you'll need to have on hand spare plugs that fit the power input jacks on your various communications devices. These plugs are usually cylindrical-style DC connectors. You can buy them separately, or in sets with some universal power adapters that you get at your local electronics supply store.

Make sure in advance that your connectors match your devices. The polarity of the connector is usually indicated on the box. However, when in doubt, the outer rim of the cylindrical connector is usually connected with the negative terminal of the power connector while the inside prong is the "hot" terminal.

In a pinch, you could simply cut the connector and a little bit of wire off the original power adaptor. Just keep in mind that this might make it difficult to revert to using the electrical grid once electricity has been restored.

Battery clamps. You'll need something to connect the wires in your circuit to the batteries that you're using. There are different options for different batteries. For instance, car batteries will need spring-laden clamps, while other lead-acid batteries usually require "fast-on" connectors.

Voltage regulators. These little components help reduce and stabilize the voltage coming in from a battery to a level that's suitable for your communications device. They can be bought for just a few dollars at most in stores that sell electronic parts, like Fry's.

It's a good idea to pick up some 78S05 and 78T05 regulators, which are 5V stabilizers in 2- and 3-ampere versions. You may also want a 78S09 chip if you expect you could need to power a 9V device. These generally come in 2-ampere versions.

You may also want to get some 78S12 regulators for your 12V equipment. Keep in mind, though, that this regulator may "lose" some Volts and output less than the number of Volts that you put into it. In other words, you might need a 14V battery to power 12V equipment with this regulator.

Capacitors. These cheap components keep the current flowing to your equipment at a steady rate despite sudden spikes in demand for electricity. Pairs of 100 nanofarad ceramic capacitors and 100 microfarad electrolytic capacitors will usually do the job and usually cost well under \$1.

Note that you have to be careful about voltage rating of the capacitors. The rating always has to be at least slightly higher than the highest voltage present on that part of the circuit. In other words, you can use 6.3V capacitors for the 5V output side, but you have to use at least 15V capacitors for the battery side. The price differences for the capacities we need are quite low though, so you can't go wrong just getting capacitors with a 35V capacity.

Heatsinks. When you use a voltage regulator to reduce the input from a 12V battery to just 5V, the regulator turns those extra Volts into heat. This could make regulator scalding-hot and maybe even lead to its self destruction.

The regulators should have their own thermal protection, but testimonials suggest it's best not to rely on this protection alone. To assure that things stay cool, attach a heat sink to your regulator. The smallest ones can be cannibalized from a dead computer power supply, however heat sinks from computer CPUs are bigger and significantly better.

You'll probably want to mount your regulator on the heat sink by drilling a hole in the heat sink and putting an M3 bolt through it. Preferably, this would be done ahead of time so you're not trying to find a working cordless drill in an emergency. Also, putting some thermal grease between the heat sink and the regulator case is strongly advised.

Resettable fuses. Because ad-hoc installations done in adverse conditions by technicians in dire need of sleep are prone to wiring mishaps, a strategically placed fuse can turn a smoky sparkly accident into an unimportant event. Resettable fuses have the added advantage that they become conductive again shortly after the circuit is disconnected, therefore you do not need to have a supply of spares, like you'd need with classical glass cartridge instrument fuses. Get some resettable fuses that are rated to handle 0.5, 1, 1.5, and 2.5 amperes of current.

Transils. When using power generated from a running car or from a gas-powered generator, there may be voltage spikes present in the feed. (The same is true if you connect anything that contains coils, like electromagnets or motors, to a battery you're using to power your equipment.) Transils clip this excess voltage so it doesn't reach — and ruin — more sensitive equipment. Transils come in two variants: bidirectional, and unidirectional. Use the unidirectional ones; they behave as Zener diodes, not allowing any current to go through until a threshold voltage is reached in the "right" direction. This means that if you accidentally swap the polarity of the battery, the transil will act as a short circuit and trigger the fuse. A Zener diode could be used too, but transils are specifically designed to absorb voltage spikes, so they're more suitable for this purpose.

Diodes. Like transils, diodes can protect your equipment when you accidentally switch the polarity of the power supply — which is surprisingly easy under field conditions. Also, there's a little voltage loss across a diode, which can be exploited for fine adjustments of the voltage needed for your communications equipment. (For instance, you could use a stabilized 5V power source and three diodes in series to make a 3V output — perfect for a device that otherwise runs from two 1.5V AA cells.)

LED diodes. LED lights are very handy as power indicators, showing that a device or cable is powered. Be sure to get some resistors to put in the circuit next to your lights so you can minimize the power the lights consume. The lights will be dimmer, but every milliamp you save counts.

Get as high a resistor as the LED allows. A rule of thumb is that normal LEDs need 10 milliamps, while low-power ones are happy with 1 mA. Take a random sample of red and green ones, but remember that there's a voltage loss of 1.5V on red and 2V for green, which can be used for adjusting the output of the 7805 regulators.

Multimeter. When you're putting your circuit together, you'll be able to troubleshoot problems quickly if you can measure the voltage and resistance across different parts of the circuit using a multimeter. The meter doesn't have to have laboratory-grade accuracy, but should be reliable and abuse-tolerant. You may also want it to have an audible indicator of a short circuit — it's much more comfortable than having to stare at the display.

Voltmeters. Though you'll have your multimeter, the difference of being able to glance quickly at a voltmeter versus having to mess with a multimeter can be significant when you're under stress. If you can, get the inexpensive analog voltmeters that do not need batteries to work. If you have one for every device you adapt, you can wire it to the battery as a direct-read battery status indicator.

Propane torch, with soldering tip. You won't have power from the electrical grid, so your electric soldering iron will be of little use when it comes time to assemble your custom power adapter. A propane torch will allow you to improvise wildly. Just remember that you'll also need rosin and tin, and probably a spare can of propane.

Hot glue sticks. The glue sticks used for hot glue gun applications are made of a useful material that can be used, not only to bond things, but also to seal and insulate parts and joints. The low melting point of the sticks means they can be melted by a candle flame, a lighter, or a propane torch.

Keep Your Kit Close at Hand

Whether you stock the must-have supplies in your kit or you double-up on everything on the list, be sure to store your kit near your other emergency supplies so that you can access it easily when you need it. Disaster situations that knock the power grid offline are difficult no matter what; but with a little planning and a bit of ingenuity, you can make sure you keep the lights on and the network up.

Check back soon for part two of this series, in which I'll take you through the steps of using the advanced supplies to build ad-hoc power adapters that keeps your communications up and running in the direst of situations.

Editor's Note: Though this article was written to be useful in emergency situations, we highly recommend that readers take the time to understand the power requirements of — and workarounds for — their equipment before a disaster strikes. TechSoup, CompuMentor, and Thomas Shaddack cannot be held responsible for any damage that might occur to your equipment should you try to power it using methods not recommended by the manufacturer.

About the Author: Thomas Shaddack is a computer administrator and developer in the Czech Republic.

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Keep Communication Equipment Powered in an Emergency, Part 2

How to convert your devices to run off batteries

By: Thomas Shaddack

November 11, 2005

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Many hubs, routers, and Wi-Fi base stations today are inexpensive and easy to configure, which makes them ideal for rapidly deploying a communications network. However, these devices usually receive their power from “brick” style power adapters and don't offer any easy way to connect a battery pack. This makes it difficult to use these devices in disaster situations, when the electrical power grid is likely to be out.

As discussed in part one of this series, gas-powered generators and power inverters are good first solutions. But when those options fail or aren't available, organizations that need to provide communications access to their constituents or employees must come up with their own solution for keeping equipment powered. More importantly, these organizations need to be able to rapidly design such a solution on-site at any time.

One way to do this is to keep an emergency kit of common electrical components and to use those components to assemble a custom power adapter that allows you to power your devices with batteries instead of the electrical grid. Readers with some background in building electrical circuits — even if just in a college lab course — should have little trouble with this project, though we recommend that you take the time to familiarize yourself with the parts and how they work before a disaster strikes.

(Please note that powering any electrical device via a method not recommended by the manufacturer could void your warranty and possibly damage your equipment. We recommend that you weigh this against the situation at hand before deciding to proceed.)

Project Details

If you were to open a standard “brick” power adapter that comes in the box with your Wi-Fi base station, you’d find a transformer, which scales the 110 or 220 Volts coming from the electrical grid down to a level that your communications device can handle. Commercial Wi-Fi gear usually runs on 5 Volts, but 6 V, 9V, and 12V are not unusual, depending on the device.

The power adapter also contains a diode bridge that converts the alternating current, or AC, voltage from the main electrical grid to direct current, or DC, which is more suitable for electronics devices. A capacitor helps smooth the ripples in the power supply so that the electrical current going to the device is constant.

Some adapters will also contain a voltage regulator, which allows the adapter to offer a constant output voltage. Without the regulator, the output could rise and fall sharply depending on which devices are attached to the regulator and how much power they need.

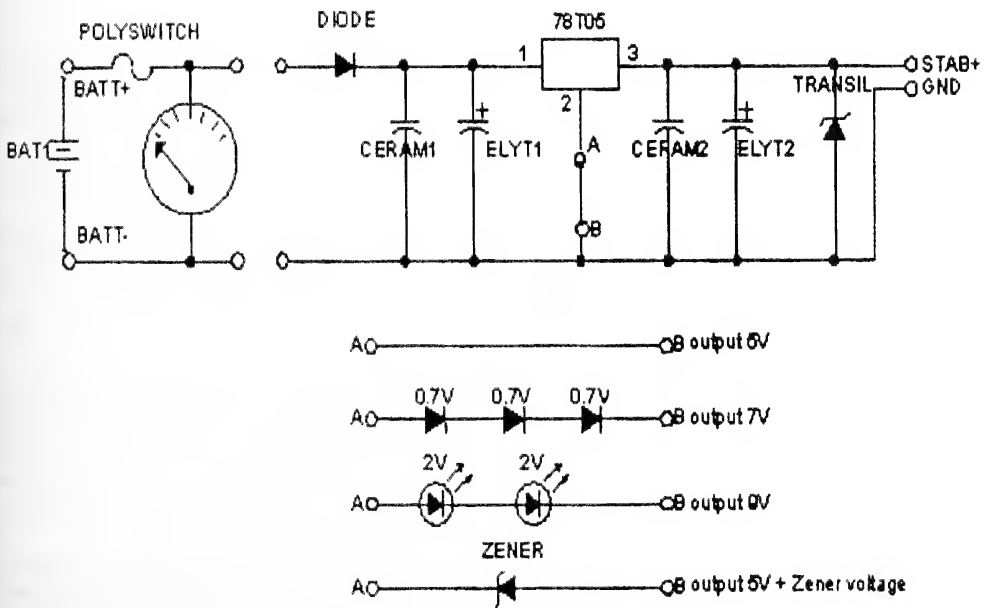
In order to mimic such a power adapter (but allow it to take input from a battery), we have to build an electrical circuit that provides the same kind of low-voltage DC power for the devices. There are four crucial steps here:

- 1. Finding and preparing a battery that will provide more Volts and amps than you need to run your device;
- 2. using common electrical components to convert the power from the battery to the correct voltage and amperage for your device;
- 3. double-checking the circuit to make sure it works as you expect it to;
- 4. and finally, getting that converted power into your device.

Assembling the Circuit

This circuit diagram shows what electrical components to connect in which spots to create your ad-hoc power adapter. If you haven’t had experience reading circuit diagrams, don’t worry — I’ll walk you through the assembly process. You will, however, want to practice using your voltmeter or multimeter first, since you’ll need that to test the battery and the circuit.

Circuit Diagram



There's just one more refrain before you dive in: When connecting cables together, whether by twisting the wire ends, by soldering, or by using wire connectors, the joints becomes a weakness in your circuit. They are very sensitive to various strains imposed by moving or pulling the wires.

Consider tying the wires together in a knot so that the knot bears the strain and protects the joint. This trick greatly enhances the reliability of connections.

However, wire connectors may be a better solution if you want to disassemble the circuit quickly — or if you suspect that someone might stumble over long wires running from the battery to the adapter. In this case, the connectors are likely to disconnect instead of pulling the adapter off the table. Similarly, tying the wire around the leg of the table before connecting it to a device on the table will transfer strain to the table leg instead of the device. This could prevent the circuit from getting scattered all over the place.

Set Up the Battery

1. Check the label or printed text on your communications device to find the voltage and amperage need to power the device. As mentioned in part one of this series, Wi-Fi gear usually runs on 5V, 6V, 9V, or 12V. The required amperage usually ranges between 0.5 and 2 amps. (Remember, Volts are like the water pressure in a pipe, while amps are like the amount of water that can get through a certain section of the pipe.) Both voltage and amperage will most likely be printed on the device somewhere.

2. Find a battery that can provide more Volts and amps than the device you want to run. It's a good idea to use a voltmeter to check that the battery is not empty. Let's assume for the purposes of this article that you have a 12V car battery. Remember that car batteries can give you quite a shock if they're mishandled. Never touch both terminals on the battery at the same time. Likewise, never touch the wires or cables that you've attached to each terminal at the same time. Finally, connect the battery to the circuit after you've completed building it — not while you're still adding wires and components.

3. Retrieve a suitable pair of battery clamps from your emergency power kit. (For a car battery, "alligator"-style clamps are best.) Then connect one end of a resettable fuse to the positive side of the clamp. Polyswitch brand fuses tend to be the easiest to find where I live, so you'll see POLYSWITCH labeled on the circuit diagram to indicate where this fuse should go.

4. Connect several inches of wire to the free end of the fuse. Do the same to the negative side of the battery clamp. (You could use longer wires if you wanted to, but you don't want it all getting tangled.) This will leave you with two dangling wires.

5. If you've got wire connectors, like the fast-on type that allow you to connect different parts of a circuit by plugging them together, connect one to each of the two dangling wires. The connectors aren't vital — you could just twist wires together as you build the circuit. But twisted wires are prone to coming apart, and connectors will make it easier to disassemble or reconfigure the circuit later. Note that if you use fast-on connectors, it's a good idea to make the dangling fuse wire noticeably shorter than the dangling negative clamp wire so you don't accidentally plug these into the wrong ends of the circuit later.

6. If you've got an inexpensive voltmeter that you want to leave connected to the circuit to act as an instant status indicator, connect it now between the two dangling wires as shown in the circuit diagram. The voltmeter is not mandatory, but it can prevent panic by telling you ahead of time when to think about changing the battery.

Wire the Circuit Together

1. Decide what you want to use to hold down the various electrical components in your ad-hoc power adapter. If you're assembling this adapter in advance of an impending disaster, such as a hurricane, it's good to use something that will keep the circuit together when you need to move it. For instance, a small box with wire connectors attached inside would work, as would an actual electrical breadboard designed for building and testing circuits. In a worst-case-scenario, you could even use a wooden shingle and just tape wires and components to it.

2. Pick a voltage regulator that will convert the voltage from your input (the battery) to the level needed for your output (your communications device.) In this case, I'm using a 78T05 regulator, which outputs 5 Volts at 3 amps or less. Use the 78S05 for 2 amps or less. The number of amps depend on what your device requires as printed on its side, bottom, or on its power connector.

- Once you add a heatsink (as described in the next step) you're going to mount the voltage regulator in the middle of your workspace and build the circuit out to the left and right. The battery will be on the far left and the communications device will be on the far right, as shown in the diagram.
3. Select a suitable heatsink from your emergency power kit. This is crucial — if it's too small, the circuit will overheat easily and that could destroy the equipment. A big heatsink normally used for high-power CPU chips is a minimum. And if that starts overheating, add a 12V cooling fan and power it by connecting wires right to the battery. You'll want to attach the heatsink to your voltage regulator. To do this, drill a hole in the heatsink, in a position that will allow you to put an M3 bolt through the hole. Then use the bolt to attach the regulator case to the heatsink. Make sure you use thermal grease and that there's a good contact between the two.
 4. Now connect the regulator-heatsink combo to your workspace, whether a box, an electrical breadboard, or just a table. Remember that, with the regulator case facing toward you and the pins pointing down, the middle pin is ground, the left is the unstabilized side (input), and the right is the stabilized side (output).
 5. Select a 100 nanoFarad ceramic capacitor (CERAM1) and a 100 microFarad electrolytic capacitor (ELYT1) and attach them to the left of the regulator, as shown in the circuit diagram. These will help filter instabilities in the current. Make sure the positive side of the electrolytic capacitor (ELYT1) is connected to the wire going to the voltage regulator, while the negative side is connected to the wire coming from the negative terminal of the battery. Also, for this capacitor, make sure you use models rated to at least 15 Volts; 35 Volts is a safe optimum, but anything above that is superfluous.
 6. Select another 100 nanoFarad ceramic capacitor (CERAM2) and a 470 microFarad electrolytic capacitor (ELYT2) and connect them to the right side of the regulator, as shown in the circuit diagram. These will filter instabilities in the output from the regulator. For the electrolytic capacitor here (ELYT2), use models rated to at least 6.3 Volts. Though the regulator outputs 5V, you want a capacitor that's rated slightly higher in case of spikes.
 7. Select any silicon diode with a current rating of 2-3 amps, depending on the current requirements panted on your communications device. The role of the diode is to protect the equipment from damage if the battery is connected the wrong way. Connect the diode wire dangling from the resettable fuse (POLYSWITCH) and the wire going to the input side of the regulator, as shown in the diagram. Mind the polarity here — we need the diode's cathode (usually marked with a ribbon of paint) to be connected to the input side of the regulator and its anode (the other side) to the battery. A diode connected backward will prevent the circuit from functioning.
 8. The transil (TRANSIL) provides additional protection from voltage spikes. If you choose to use it, attach it to the right, or output, side of the circuit. Mind the polarity. As with diodes, the cathode side of the transil is usually marked with a stripe and should be connected to the wire coming from the regulator output. The anode side of the transil should be connected to the wires, then connect the negative side of the battery to the ground side of your communications device.
 9. Attach to the two rightmost wires in the circuit — the stable (STAB) and ground (GND) wires — a power plug connector that fits the device you want to power. But do not connect the device yet.
 10. If you've got a device that needs more than 5V to operate, you can raise the output voltage of your adapter by connecting different components between the points A and B in the diagram. If you just run a wire directly between the two points, your adapter will output the nominal voltage from the regulator. But if you insert three silicon diodes or one yellow-green LED, you can raise the output voltage by approximately 2V. Likewise, two yellow-green LEDs can be used to add a total of 4V. For other voltages, you can use a Zener diode.
 11. Wrap up the work. Make sure all the electrical components are well affixed, and make sure the wires aren't so tight that they're tugging on the components.

Check the Circuit

1. Set your multimeter to its ohmmeter mode and make sure there is no short circuit anywhere in your ad-hoc power adapter. For instance, the meter should indicate there is some resistance (measured in Ohms) between the circuit's ground and input wires, and also between its ground and output wires. But that resistance shouldn't be too small: zero to a few Ohms is wrong. Also, the measurement between the input and ground should show a higher value than the measurement between the output and ground.
2. The DIODE should be conductive in the right direction — meaning that when the multimeter's positive wire is connected to the diode's free end and the multimeter's negative wire is connected to the input side of the regulator, the multimeter should show some small resistance on the order of tens to hundreds of Ohms. Alternately, when you swap the wires, there should be no conduction. This should appear as either an "infinite resistance" measurement or values in the megaohms.

3. Make sure all the parts that should be connected to the ground (GND) are connected to it, as shown in the diagram. A visual check is usually enough if you trust your wiring skills. But a check with a multimeter can't hurt.

4. The TRANSIL should be conductive — like the diode — when the multimeter's positive lead is connected to the transil's ground side and the multimeter's negative lead is connected to the output of the regulator. When you swap the leads, the transil should become nonconductive.

Do the "Smoke Test"

1. Connect the end wires from the battery clamps to the input wires of the circuit. The positive wire from the clamp connects to the free end of the diode, and the negative wire connects to the common ground.

2. Connect the negative clamp to the negative (-) side of the battery.

3. Touch the positive clamp to the positive (+) side of the battery. If you did everything right, nothing visible should happen. If smoke appears, review the circuit setup and replace the part that started smoking. This probably won't happen, though, since the diode prevents you from connecting the circuit the wrong way and the resettable fuse protects you in case of short circuit. A tripped fuse will be warm or hot to the touch and almost nonconductive if tested with the multimeter (in ohmmeter mode.)

4. Check the voltage at the output of the circuit. It should be almost exactly 5V (if using a 78S05 or 78T05 regulator with nothing but a wire connecting points A and B on the diagram. Anything between 4.8 and 5.2V is generally acceptable. Devices are typically tolerant to variants of plus or minus 10 percent of the nominal voltage.

5. If everything seems to be okay so far, connect the device itself to the plug on the right side of the adapter. Check the voltage at the output of the circuit — it should not drop significantly. The device should come alive. If so, congratulations!

Keep the device operating for a while. Monitor the temperature of the heatsink. If it heats up too fast, or you can't hold your hand on it even for a short while, disconnect the whole unit from the battery and remount it to a bigger heatsink, or add a fan.

In Conclusion

There's no doubt that working with electrical components for the first time can be daunting. Certainly, you have to take your time, do your research, and stay safe. But, hopefully, the instructions here (and in part one of this series) have given you the inspiration to begin planning your organization's emergency power needs. As you get more comfortable with the different methods of keeping communications equipment powered, you'll soon find that you've got the skills to handle most any power emergency in stride.

Editor's Note: Though this article was written to be useful in emergency situations, we highly recommend that readers take the time to understand the power requirements of — and work-arounds for — their equipment before a disaster strikes. TechSoup, CompuMentor, and Thomas Shaddack cannot be held responsible for any damage that might occur to your equipment — or injury that might occur to you — should you try to power it using methods not recommended by the manufacturer.

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The Terrorist Threat to Zoological Institutions

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Introduction

Historically, North America has avoided the direct impact of terrorism that has long plagued the international community. The events of September 11, 2001 clearly indicate that the United States has been effectively targeted and we as a nation will never again realize the tranquility we once enjoyed. What had previously been in many ways within the purview of law enforcement agencies and the military establishment is now part of the daily lexicon of mainstream society. Still, while the concept of terrorist activity is not new to the world at large, the impact is clear, and while the other nations of the world have adapted in a physical and social sense to modern terrorism, this is still a relatively new facet of American society.

Yet, this fails to define terrorism and what motivates an individual to take this type of action. In essence, societal elements exist that could be described as individuals who have an agenda without a venue and therefore resort to radical action to achieve their goals. Working from this premise, terrorism is supposed to be a shortcut to the moral high ground and any action is justifiable within the mindset of the disenchanted. Clearly, the end does not justify the means within the world society as recent events have illustrated, regardless of the nature of the cause.

While the acts of legitimate nations at war are often considered inappropriate or inconsistent within the premise of civilized behavior, and may be subject to the judgment of history or war crimes tribunals. The overall concept of warfare is legitimized by the actions of recognized countries and nationalities, not the actions of any one individual or group of individuals. The ramifications of extreme radicalism dictate that what was once a social issue has become a political cause worthy of notice, concern, and action.

It is then possible to develop a working definition of terrorism. Terrorism: any *illegitimate* act of violence or the threat of violence, especially bombing, kidnapping, and assassination, carried out for political purposes. In essence the focus has shifted to the *act*, rather than the *purpose*.

Currently there are two categories of terrorism recognized by the Federal Bureau of Investigation (FBI), international and domestic:

"International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. Acts of international terrorism are intended to intimidate or coerce a civilian population, influence the policy of a government, or effect the conduct of government. These acts transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to intimidate, or the locale in which perpetrators operate."

"Domestic terrorism is the unlawful use, or threatened use, of violence by a group or individual based and operating entirely within the United States (or its territories) without foreign direction, committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives."

In practice, terrorism comes in many forms, but by definition terror need only be associated with an event, not actually carried through to completion. This is what makes terrorism such an effective tactic; it is the ultimate *variable reinforcer*. The implied threat is all that is necessary. If a terrorist faction detonates an explosive device in a crowded urban shopping mall, it then maximizes physical and collateral damage, which is considered optimal by the terrorist. Thereafter, the responding agency (be it military or law enforcement) must treat each perceived threat as a real crisis, simply because the 20th telephone threat may be an actual event. For the terrorist, it is not only extremely expedient, but cost effective as well.

While a direct attack on a zoological facility by international terrorists is unlikely and may never occur, the potential does exist. This must be tempered with the knowledge that in 2000, more people visited AZA-accredited zoos and aquaria than attended professional football, baseball, hockey, and basketball games combined. Zoological institutions have become not only stewards of conservation, but of the public that visits our facilities as well. The potential of mass casualties resulting from a nearby terrorist action that could effect a facility should not be dismissed.

While the concept of international terrorism and politically-motivated violence is easy to view and understand on the world stage, domestic terrorism is more complex. Specifically, right-wing extremism has overtaken left-wing extremism as the most dangerous threat within our country in the last decade. This can be best characterized by special interest terrorism, which seeks to resolve specific issues, rather than effect widespread political change. Special interest extremists conduct acts of politically motivated violence to force segments of society to change or shift attitudes about cause-oriented issues. The FBI currently estimates that environmental-based (eco-terrorism) special interest extremists have committed more than 600 criminal acts in the United States since 1996, resulting in damages in excess of 43 million dollars.

Though terrorism is by no means a new phenomenon, recent events in the Near East and other parts of the world, have given indication of a new wave, or resurgence in anti-American, anti-establishment activity, both domestically and overseas. It should be clearly understood, that in a free society, it is impossible to identify and arrest every offender, both real and potential, and prevent all acts of terror. With this in mind, it is prudent for operators of businesses or organizations wherein the public congregates, to take basic steps to reduce threats, to facilitate law enforcement access, and to minimize casualties and minimize liability, in the event of a terrorist act.

Should a major attack occur on your property, (unlikely), or in the vicinity of your facility, (more likely), such as a chemical attack, or aircraft crash, your assets will be overwhelmed. Take basic, common sense precautions; however don't concern yourself too much about this type of incident. An attack of this magnitude is for county, state, and federal officials to handle. The most favored terror weapon is still explosive devices such as pipe bombs and fragmentary devices. The following suggestions will assist in minimizing casualties and in the rapid treatment and evacuation of the injured.

The basic components of security for a zoological institution fall into two categories, basic and advanced security. The key discriminating factors are the complexity of physical preparation and the level of intrusiveness. Conversely, the fiscal costs associated with the level of security are in direct proportion to the level of preparedness. As a result, advance planning from a fiscal standpoint should be considered an integral part of the development process. An often overlooked or underestimated key factor of security is the relationship that a zoological facility and its staff develop with other municipal and governmental agencies. This will play a critical part in the successful response and resolution to any crisis situation be it terrorist-related or otherwise.

Security

I. Basic

- Inspect and evaluate the effectiveness of all security measures throughout your facility. Use the risk assessment to guide your facility towards a state of preparedness.
- Inspect primary containment of the exhibits as well, which by design lends itself more towards preventing animal escape, rather than prevention of human entry or releases.
- Inspect all locks, chains, and deadbolts. Perform maintenance on an annual basis or as needed. Inferior quality or locks in poor repair should be upgraded and replaced.
- Perform a key inventory and develop a key control program that restricts key access.
- Areas that restrict public and staff access should be clearly marked with the appropriate graphics to indicate the level of access. Staff members should adhere to protocols.
- Staff members should avoid shortcuts, which result in open or unattended gates or entry points. Gates should be secured whenever they are not in immediate use by the staff.
- Lighting at night along the perimeter should be the strongest followed by entry points into the facilities and the animal service areas. Ideally, all exhibits should have the ability to be lit in an emergency as well. Regular inspections and maintenance are key elements to maintaining this deterrent.
- Solar power should be considered a viable alternative for lighting public and staff work areas, as well as maintaining hot-wire systems for animal exhibits.
- Develop alternate forms of electrical and water supply for emergency operations.
- Consider purchasing a stand-by generator to maintain vital services.
- While landscaping is a key component of the natural look of a zoological facility, it should not interfere with security measures, provide potential hiding places, or invite entry along the perimeter of the facility. Inspect on a regular basis.
- Trash and debris should be removed at all times, as they provide potential hiding places and can interfere with security measures.
- Inspect storm drains, sewers, underground service areas, or anything else which provides access out of your facility. If something is designed to allow passage out, it can surely be used to get in. Cover access points with hinged rust-resistant steel grates equipped with water-resistant high security locks that are designed to deter cutting.
- Inspect and reinforce all public areas equipped with Lexan[®], Plexiglas[®], or tempered glass. Typically these will be found in or near exhibits for public viewing. Inspect regularly and upgrade as needed to reduce the risk of potential vandalism.
- Consider the use of burglar bars and security lighting near any administrative, laboratory, research, or veterinary service buildings. They should be considered high-profile targets.
- Potential staff members should undergo extensive background checks prior to hiring. This establishes identity, credentials, and a proven work history. Verify all identification with the issuing agency through your Human Resources Department.
- Staff members should always be in some level of issue uniform.
- Staff members should be issued tamper resistant identification cards and it should be mandatory that they be worn on the uniform in the workplace.
- Always introduce new members of the staff; it's not only courteous, it's good security.
- Encourage staff to "be aware" of unusual activity or people taking pictures with sensitive areas as background. Advance surveillance activities should be an area of concern.
- Unknown persons in restricted areas should be challenged and identified.
- Access to a facility by volunteers should be closely controlled and monitored.
- Contractor access should be controlled and monitored through issued temporary identification cards. Also, contractors should always be accompanied by an animal management staff member when entering animal work-related areas.
- After-hours access to a facility should be rigidly controlled. There should be a provision for sign-in/sign-out procedures with visual confirmation by the night staff.

- Commercial delivery vehicles should be clearly marked and the drivers should be in a recognizable uniform. Identification should be confirmed and packages inspected.

II. Advanced

- Fence perimeters with a substantial 8-foot (minimum height, not chain link) fence, with a top, which discourages climbing over. This can be done with tasteful architecture.
- Insure exit gates can be opened wide in the event of a rapid evacuation. Consider installing extra-wide gates, which are normally closed, but which can be opened to allow large crowds to pass thru quickly. Be sure they open toward the outside of the perimeter.
- Utilize architectural techniques to break up and channel crowds to exits and parking areas. You should have at least two, wide avenue exit routes, from your property, opening on different sides of the perimeter. One is for emergencies only.
- Turnstiles are strongly discouraged as they prevent rapid evacuation of visitors.
- Public parking should be restricted to a distant location if possible, to avoid direct access within 300 feet of an occupied staff building or complex area.
- Staff members should be provided with a secure parking area located within the perimeter that requires coded access and has minimal gate access.
- Minimize gates in back lots, and remote areas. Use good tamper resistant locks.
- Profiling. While profiling is controversial, it has been used effectively by law enforcement agencies. It is probably best to check with your attorney's office first before instituting a policy. Also, cooperation with your local law enforcement will be necessary to update changes in threat levels.
- Physical searches at the point of entry are being used at a few facilities as of this writing. Once again, best to check with your attorney's office before implementing a policy. While some visitors may find it reassuring, others may not and may object to searches. A more effective approach would be to consider limiting what the public can physically bring into the facility instead.
- Consider prohibiting backpacks, duffels, packages, bags, and coolers from public entry.
- Cameras and electronic surveillance range from inexpensive progressively to expensive, {conventional, telescopic, starlight (Generation I-III), and infrared (active and passive)}. It simply depends on the perceived threat level and what your budget can bear. Also, they are useless in the preventative sense without a staff member or service to monitor and interpret what they are seeing, (an additional expense). Still, it is a very time-effective approach to monitoring large areas of a facility.
- Metal detectors, (when they work properly) can be an effective tool. But, legal considerations, cost, and the visitor perception should be taken into account prior to implementing use.
- Explosive material detectors, (when they work properly) can be an effective tool. But, once again, legal considerations and the visitor experience should be taken into account prior to implementing a policy of use.
- X-Ray scanners, (when the operator has been properly trained) can be extremely effective. Once again, be aware of the legal aspects and the possible negative public perception of usage.
- Automated alarm systems can be effective when equipped with an alternate power source in the event electrical service is interrupted or fails. Monitored systems are best.
- Uniform and non-uniform security can be an extremely effective element in deterrence and response, provided they have been properly trained and are reliable assets. Unarmed security elements are best used as a deterrent or for first aid. As a result, the use of armed peace officers or security guards would be more advantageous in a crisis.
- Biometric security measures, a relatively new aspect of security in the military and private sector, can be highly effective in unmanned access control. In short, it uses a discriminating physical characteristic, which it compares to its database. It is historically expensive, but is becoming more affordable. Still, swipe cards incorporating photo ID's are frequently used in the corporate work place and are an affordable alternative.

Advance Planning

I. Basic

- Evaluate the role your staff will play in an emergency situation.
- Evaluate the role your Emergency Response Team/Crisis Management Team will play.
- Evaluate how you will handle human and animal triage for mass casualties.
- Develop an evacuation plan – public, staff, and animals.
- Develop an emergency secondary site for animal holding with logistical support.
- Develop maps denoting fire extinguishers, first aid kits, fire hydrants, entrances, and cut-off points for water, natural gas, and electrical service. Purchase emergency control tools.
- Procure and maintain two-way radios for all staff members. Purchase extra batteries.
- Procure, issue, and maintain flashlights for all areas. Extra batteries are recommended.
- Distribute directional graphics inside your facility designating first aid, exits, security, telephones, and other vital visitor services, preferably in multiple languages.
- Do not understaff the Visitor Services area, as they can perform a vital role in answering questions, guiding the public to safety in an emergency and controlling panicked patrons.
- Consider purchasing bullhorns for Visitor Services and Security to use in a crisis.
- Provide or facilitate first aid and CPR training for staff members to prepare for first responder situations. Keep certifications current.
- Procure first aid kits for dispersal throughout the facility. Kits should be inspected on an annual basis and refilled as needed.
- Identify and locate the nearest full trauma care ER unit.
- Discuss emergency procedures with staff and ensure that they understand their duties.

II. Advanced

- Seek professional assistance from local law enforcement (LLE) and governmental agencies in your area. Ask them for suggestions and if they would provide staff lectures to facilitate training. Allow SWAT units to reconnoiter your grounds.
- Contact your emergency services such as LLE, Fire-Rescue, and EMT's. Ask them to tour your facility and make recommendations to promote access and communication.
- Develop a contingency plan for fire and medical emergencies and practice regularly.
- Develop a bomb incident plan, train the staff in its use, and practice regularly.
- Obtain site maps and ensure that LLE and Fire-Rescue has up-to-date copies.
- Identify and mark emergency vehicle and entrance and exit routes. Identify an entry that will unobtrusively allow police vehicles to enter and park on grounds.
- Identify a location from which emergency personnel could operate and coordinate action.
- Identify a trauma care site (TCS) on grounds equipped with trauma kits.
- The TCS should have FAX and telephone connections, and a power supply as well. An emergency cell phone, which displays your facility name on Caller ID, should be available.
- Several facilities have chosen to out-source EMT's for their facilities or train existing staff due to fiscal constraints as opposed to adding full-time permanent staff.
- Develop a relationship with your Employee Assistance Program (EAP) for post-traumatic counseling for your staff.

III. Liability

- Expect to be sued in the event guests are injured on your property in a terror incident.
- Consider every decision you make in the light of how it will sound on the witness stand.
- Consult with your attorney's office during policy development.
- Review the written policy for a legal opinion once it has been developed.
- Adhere to the established policy whenever feasible in the crisis.
- At the earliest opportunity interview staff members and document the event.

Public Relations and the Media

Should a zoo be concerned about public relations in regards to a crisis? In a single word, yes. How an institution deals with the media after a crisis can directly impact the public perception of a facility for years to come. When dealing with the media there are some basics to do and to avoid.

I. Things to Do

- Develop a media policy.
- Establish an on-going relationship with local newspapers, radio stations, and television.
- Offer them onsite tours of your facility including behind the scenes tours.
- Nurture that relationship with the media, and keep them involved.
- Develop a series of prepared statements for every reasonable contingency. Work from the statement until detailed information is available to brief the media.
- Designate a spokesperson that is the primary media contact person for your facility.
- The spokesperson should be credible and well versed in public speaking.
- The spokesperson should be the sole source for information.
- Develop an on-site location for publicized press releases.
- Tour the site with the media technicians to insure that you can meet their technical needs
- Provide timely updates through press conferences and releases.
- Provide ongoing media tours of the facility in action.
- Provide ongoing updates of the facility during the recovery period and let the public know that you're still there and can use their support through volunteerism and donations.
- Publicize the re-building effort; never let them forget our professional commitment.

II. Things to Avoid

- Never use multiple spokespersons. It provides the impression of poor organization and can lead to conflicting and inaccurate information.
- Always work initially from a prepared statement when dealing with the press. Always stick to the facts, don't disclose any names, provide a brief description of events to date, and the course of action. This removes possible misinformation and probable liability.
- Always be honest. A failure to do so will haunt your institution and render future comments suspect. Credibility is everything in the media.
- Never say "No comment". It only invites the press to find their own answers. These answers often will be erroneous, half-truths, and downright lies from unreliable sources.
- Never release the names of an injured or deceased employee. Not only is it inappropriate, but it also could be devastating to their families and injure staff morale.
- Never give an "off-the-record" statement or interview. There is no such thing. What you say in public record is just that. If you don't want the press to know, then don't say it.
- Never speculate on what you believe happened. It can lead to incorrect conclusions and possible lawsuits. Stick to the facts and provide details as they develop.
- Never give the press unlimited access to your facility. It only invites trouble. Media professionals are just that, not zoologists. A staff member should always accompany members of the press. Don't invite a second crisis incident.
- Remember to be professional at all times if that is the image you wish to portray. Perception is everything in the world of media and people believe what they read in print, hear on the radio, and what they see on television.
- It's also a good idea to have a media archive service monitor and collect all video footage and a computer research service to provide a copy of print material on an annual basis.
- Don't forget to keep your staff informed for the sake of good morale.

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Hurricane Preparedness: Lessons Learned from Hurricane Katrina

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On 29 August 2005, Hurricane Katrina made landfall just east of the city of New Orleans as a Category 3, with maximum wind speeds of 130 mph. Although the storm was fierce, it had been downgraded from a Category 5 before coming ashore. Inhabitants of the city breathed a sigh of relief Monday afternoon when the winds abated. However, it was not long after that an even bigger threat became evident: the levees surrounding this city sitting below sea level had failed, flooding 80% of the city.

The Audubon Zoo had a well-prepared Hurricane Protocol in place prior to Hurricane Katrina. Preparations for hurricanes had followed the protocol in the past. However, it was not until Hurricane Katrina that the protocol was fully implemented. It is this plan and those who put it into place that enabled the Audubon Zoo to survive for more than a week without outside help. The hurricane procedures were adapted from lessons shared by the Miami MetroZoo after Hurricane Andrew, a Category 5 storm, devastated the zoo in August 1992.

The Audubon Zoo suffered severe tree destruction, downed fences, and moderate building damage but no flooding. The zoo is located on a ridge adjacent to the Mississippi River and is one of the highest parts of the city. When the levees failed north and east of the city, the water was displaced to the lowest parts of the city. The zoo was spared devastating flooding. However, 80% of New Orleans was flooded with 6 to 10 feet of water. Thousands of the city's residents died in the wake of the flooding. Thousands more were stranded without food and water for five days or more.

With the city in chaos, its infrastructure collapsed, and local and federal rescue agencies focused on saving human lives, the zoo storm riders were on their own. There was no outside help for one week. There was no running water for more than ten days and no electricity for more than 15 days.

Pre-storm

Although it is impossible to be prepared for every scenario, it is worth trying to anticipate problems and potential solutions.

Plan on not having electricity or water for a minimum of seven days.

It is important to work with the local branch of the Office of Emergency Preparedness (OEP) before hurricane season begins (June 1). Government officials may be able to generate credentials for the facility's storm riders, but do not count on it. Identification cards for police changed three times after the storm. However, if credentials are available for hurricane team staff, they will allow for easier movement around the post-storm city that may be declared to be in a "State of Emergency". Establish contacts at local government facilities and hospitals (including National Guard). This will facilitate good relations in the days before, during and after the storm, but be prepared for any scenario. Some agencies may focus on their own agenda, putting the zoo's interests at risk. Pre-planning is a must, but guarantees provided by agencies prior to landfall may be impossible to honor in the aftermath of a catastrophe.

Audubon Nature Institute appointed one person to stay with the mayor and the focus of city government during the hurricane in order to represent the Audubon facilities. The wife of Ron Forman, Audubon's President & CEO, was Mayor Ray Nagin's Communications Director, so Ron was a natural choice to remain with his family and the Mayor's team at a hotel conference room downtown. He also managed to visit the Audubon Aquarium and drive from downtown to Uptown to check on the storm riders at the zoo. Not only was this crucial to protect the interests and assets of the Audubon Nature Institute, but it was also very important for boosting the storm riders' morale.

Because of his unique position during and after the storm, Ron was able to recruit New Orleans police officers to help feed the animals at the aquarium in exchange for providing the police with a place to station their operations (their headquarters had flooded). In addition, on Day Five Ron recruited two New Orleans police officers to stay with the team at the zoo to provide added security.

A structural engineer should visit the facility prior to hurricane season to determine the best place for storm riders to stay (in terms of wind strength and elevation). For the Audubon Zoo, the base camp was the Reptile House, a two-story brick building with small windows situated in a high part of the zoo. Storm riders slept on cots in the visitor area.

Team Leader - A single point person leading the team on-the-ground is essential to promote group cohesiveness, preserve the chain of command and serve as the primary contact with outside agencies.

- Through the Katrina experience, Audubon Zoo's General Curator was the "ranking officer" and assumed this role.
- Among his many duties, the "GC" negotiated for supplies with the National Guard, New Orleans Police Department and New York City firefighters.
- He appealed to a nearby hospital to "borrow" their electrician in order to repair the Swamp exhibit's life-support generator.
- He made the first call to neighboring zoos for help and served as the Association of Zoos and Aquarium contact on-site, as he worked to prevent the animal collection from being prematurely dispersed.

Outside Storm Coordinator - This person works for the facility and should evacuate well in advance of an oncoming storm.

- He/she should have direct communication with the storm riders. This person serves as a link between the people on the hurricane team and the upper management who have evacuated.
- In addition, this person can contact storm riders' family members (via phone or email) to keep them apprised of the situation. It was very stressful for the families and friends of the storm riders in New Orleans when there was no news from them (due to cell phone failure). The national media only exacerbated this situation.
- Also, this person can help with the logistics of getting people on the initial hurricane team out and getting the relief team into the post-hurricane zone.

Upper management should establish a hotline, website, email address, phone list, etc., to keep evacuated employees (dispersed among many different states) informed of what is happening. Communication is crucial. If employees are terminated, Human Resources should issue a letter stating as such or phone the employee. Although this seems to be an obvious course of action, several institutions in New Orleans did not tell employees they had been furloughed. At the Audubon Nature Institute, 75-80% of the staff was laid-off in the weeks to months after the storm. However, many of those people were rehired as finances improved.

Evacuation - Knowing when to close the zoo in order to initiate hurricane preparations is a dilemma.

- How do you decide how long employees should stay to help with hurricane preparations while giving them sufficient time to tend to their own family emergency plans?
- If people leave too late, they will not have enough time to leave the city before bad weather arrives.
- If they leave too early, the storm riders may have extra work to do (ie, storm riders were still making sand bags and boarding windows until the evening before the storm...).
- Also, what happens if the city orders a mandatory evacuation?

These are issues that are best addressed before hurricane season. In Audubon Zoo's case, most employees helped with preparations two days prior to the storm and evacuated thereafter. Hurricane team members finalized hurricane preparations at the zoo the day before the storm.

Equipment Relocation

- Information systems main frames were evacuated in advance of the storm outside the city along with records, important documents and research material

- Audubon's financial center was maintained outside the city for weeks after the storm. This enabled paychecks and other financial obligations to be distributed.
- Computers and important medical and other equipment were placed in waterproof containers or covered and placed in a high and/or dry/secure place, preferably without windows.

PERSONNEL (Storm Riders/Hurricane Team): Storm riders are responsible for the welfare of the animals and for protecting the facility during and after a storm. Staff are on the team voluntarily. At the Audubon Nature Institute, storm riders on team A stay on zoo grounds in the event of a Category 3 hurricane or higher. Staff on team B are back-up in the event that a person on team A is out of town or otherwise unable to stay at the zoo. If the storm were very severe, the storm riders would not necessarily have to stay at the zoo. This would ultimately be decided by the head of the hurricane team and/or the President and CEO of Audubon Nature Institute.

In the event of a Category 2 storm or lower, the team A storm riders can return to their homes. However, they are expected to be the first ones to return to the zoo to care for the animals and initiate debris clean-up. All employees are expected to report back to work as soon as possible, but this will vary depending on the severity of the storm.

Originally, there were nine people on the hurricane team. However, during Hurricane Katrina, extra staff and a former Audubon Zoo veterinary preceptor stayed with the storm riders, for a total of 14 people. Some people did not have a car or could not otherwise evacuate. The extra help proved vital in the several weeks following the storm. Our original team of nine may have been too small. For the next hurricane season, Audubon opted to have 20 people on the hurricane team.

Team versatility, such as including swing keepers who are familiar with more than one aspect of the zoo, was a very important feature in developing the storm rider team. Three of the team also happened to be trained in firearms use.

Examples of storm riders on Audubon Zoo's 2005 hurricane team include security guard, veterinarian, keepers from bird, primate, reptile departments, and horticulturist (proficient in using heavy machinery). Storm riders also included the General Curator, several other department curators, hospital and various keeper staff.

Other types of professionals to consider having on a well-rounded, versatile hurricane team include the following: medic (it is beneficial to have someone familiar with human first aid/CPR or to have an EMS on the team), chef to coordinate meals for storm riders, mechanic, and electrician, to name a few.

Storm riders and those involved in storm preparation met once monthly during hurricane season and more frequently as a storm approached.

Storm riders are encouraged to have extra medications (order a three-month supply for hurricane season).

- We obtained certain crucial prescription drugs (ie, anti-hypertensive drugs) from the local human hospital in the days after the storm.
- Ensure that basic medications are available to the storm riders (ie, antibiotics for diarrhea/respiratory infections, OTC anti-diarrhea and cough medications, etc).

Each storm rider should carry a personal medical history and give a copy to the "outside storm coordinator" prior to the hurricane season. Audubon developed medical history forms that all storm riders completed. All medical information is kept confidential and only used in case of an emergency. Storm riders should be current on vaccinations, such as tetanus and hepatitis A and B.

Bathing - With temperatures in the mid-nineties and grueling labor to remove debris and tend to the animals at the zoo, the storm riders were very dirty.

- Hand sanitizers were very important for keeping hands clean.
- Without running water and no way to utilize large quantities of water from the 800-gallon bladder on the ground, it was not easy to keep clean. Fortunately, there was a pool

on property that we used for bathing for a week after the storm. However, without filtration, the water became very unsanitary after six days of usage. At this point, we were able to rig a shower by pumping water from the ground up to a tank placed on the roof of the Reptile House. Gravity fed the water into a garden hose with a nozzle on the end. After using this shower, it was probably the cleanest we had ever been since the storm!

Clothing - With water a scarce commodity, we were reluctant to wash clothing. Although most storm riders had enough clothes for seven days, it was 8-10 days before we had access to outside supplies. Needless to say, one of our first requests to people who brought in supplies was for underwear and socks!

Toilets - Without running water, we tried to conserve what little we had stored. We followed the rule, "If it's yellow, let it mellow; if it's brown, flush it down." Regardless, without sewerage services, flushing was not always 100% successful. This made for less than ideal sanitary conditions for storm riders and could have posed a risk to their health. The Zoo purchased several portable chemical toilets for a previous hurricane, but they were never deployed for Hurricane Katrina. Full-size, "porta-loos" would be useful, but it would be necessary to secure them to prevent wind damage.

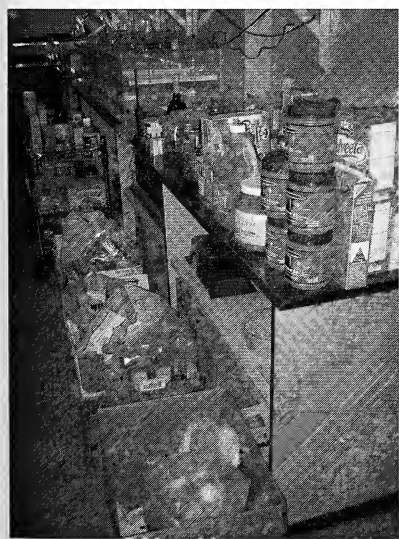


Makeshift shower atop the Reptile House used gravity to help keep Storm Riders clean.

Fatigue is a major problem in the days after the storm and can contribute to accidents. This can be a big issue because storm riders are working around dangerous animals and heavy machinery. One staff member sliced his finger down to the bone. Fortunately this happened 10 days after the storm when the National Guard had secured the city. We were able to flag down an ambulance, and he received prompt medical care, which most likely saved his finger. However, had this happened five days earlier, the outcome might have been much different.

SUPPLIES:

Generators - These provided power for the storm riders and for the coolers/freezers for animal and human food. They should be tested weekly in non-hurricane season. Ensure that these are properly ventilated to prevent carbon monoxide poisoning.



Stockpiled foodstuffs kept Storm Riders fueled during Hurricane Katrina's aftermath.

Fuel - It was crucial for the Audubon Zoo to have its own diesel and petrol tanks. This gas powered our generators and some of our heavy machinery that was used to move debris. Gas stations in the city ran out of gas the day before the storm. Also, those that still had gas did not have a way to pump the gas because there was no electricity. The day after the storm, 38 police cars arrived at the zoo to fill up their cars with gas. Before learning the zoo had gas stores, they had been siphoning gas out of abandoned cars.

Charge two-way radio batteries and ensure flashlights are in good working order prior to the storm. Each section of the zoo should have a flashlight with spare batteries readily available. Extra lighting might be necessary in high-risk areas (dangerous animals).

Food - We had sufficient food supplies for two weeks. Much of the non-perishable food, including meals-ready-to-eat (MREs), had been purchased prior to the hurricane

season. However, anyone who has eaten an MRE more than two days in a row knows the importance of having a well-cooked meal. Post-Hurricane Katrina we tried to have one warm, cooked meal a day, which was essential to provide energy for the physical labor engaged in daily. Also, the freezer for the zoo's catering service was not on a generator. Without electricity, the food was going to spoil. Thus, it was the storm riders' duty to not let the food go to waste. Thus, we were able to dine well on already-prepared, thawing crawfish etouffee and jumbalaya.

Water -

- We stored water in sealed and open containers, mostly utilizing 50-gallon drums, situated throughout the zoo that were to last us for ~3 days. However, it was six days before an outside water truck replaced reserves. Also, water stores for megafauna were insufficient. It would be prudent to calculate the daily water intake of the larger species and store water in volumes to meet those needs. Also, plan on storing sufficient water for at least 12 to 14 days.
- Natural water sources can be used to provide water for animals. In the Audubon Zoo's case, fences often needed to be repaired before animals could be released into exhibits with natural water sources.
- In preparation for the hurricane, we filled two 800-gallon bladders of water for human use. These bladders were unrolled on the ground outside base camp at the Reptile House. These bladders were an important source of water for us. However, it was difficult to fill large containers of water because these bladders were on the ground. We had an empty bladder of water that we placed on the back of a truck. The National Guard provided us with water to fill up the bladder on the back of the truck (using the levee to allow gravitational movement of water). Once the water bladder was mobile, it was easy for us to move large quantities of water around the zoo. Although an elevated bladder might be at risk of storm damage, it would be prudent to have one filled in the back of a truck prior to the storm to ensure easy transport of water around the facility.

Machinery - It is important to have sufficient equipment (forklift, chainsaws) for moving debris, trees, etc. on hand.

- Spare parts (chains, lubrication) and tires should be available to fix this equipment. With all of the debris on the ground, we experienced many flat tires that slowed the recovery process.
- Extra chain link in rolls should be available for repairing fences (deer fencing can work, too).
- Ensure that staff can work safely - safety glasses, gloves, insect repellent, and first aid kits should be provided.

Communication - Two-way radios were a very helpful way for team members to communicate within the zoo. Reliable communication outside the zoo was harder to achieve. All cell phones are unreliable in the days after the storm, and most will not have service. Text-messaging was the most reliable form of communication, although many of the storm riders' cell phones did not have this capability. Our satellite phone was disappointing because we were unable to obtain good reception due to our low-lying position. However, this may be a good option if the landscape permits (wide open spaces, higher areas).

Records:

Send multiple copies outside the state for safekeeping. Also, ensure that paper medical records are up-to-date. It was several months before we could use Medarks® to access computerized animal records, and many of our paper records were incomplete. This was a problem for post-storm relief vets who were unfamiliar with our animals.

Zoo Animals:

Ensure there is an updated and accurate inventory for all animals. This is important for storm riders who may be caring for animals that are not normally under their care. Also, this is necessary if animals must be evacuated to another facility. Written and clearly-stated diet information posted in the vicinity of the animals is essential. Although it is nice to have diet information in an electronic format, if there is no electricity, it may be difficult to access these documents.

Miscellaneous problems encountered around the zoo:

Small amphibians - size-appropriate crickets and other invertebrate food ran out quickly.

Marine mammals and fish- generator to ensure pumps keep the water clean

- Our generator to power the sea lions' water filtration system failed. After eight days without filtration, the water was uninhabitable for those animals and was a threat to their health.

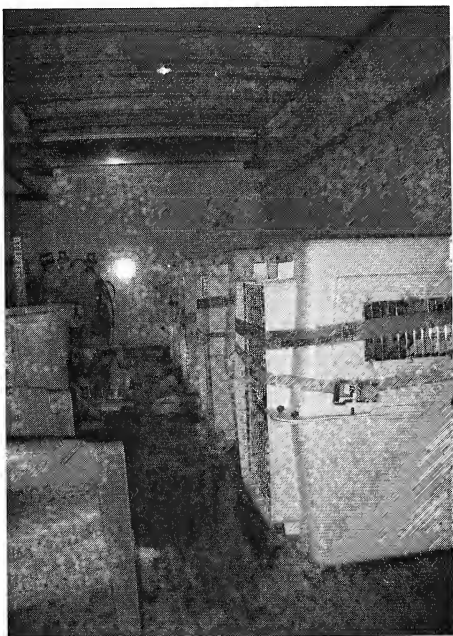
With the help of several local zoo facilities (Alexandria, Baton Rouge and Houston Zoos) we were able to safely evacuate the sea lions and otters to a holding facility with appropriate habitats.

- Although it may be too costly to evacuate marine animals prior to a storm, it is prudent to have a post-storm evacuation plan in place before the start of hurricane season.

Birds -

- Indoor aviaries with clear ceilings become greenhouses if the air conditioning fails, which happened at the Audubon Zoo. In our situation, we constructed small mesh screened doors in order to open the aviary doors to the outside to allow air to circulate.

- Rooms that allow natural light are very important for diurnal species. A pair of wrinkled hornbills (*Aceros corrugatus*) was moved to a quarantine room without windows in preparation for the storm. Because their original habitat was destroyed during the storm, we were unable to return them to their exhibit. Without electricity the room was in complete darkness 24hrs a day. These birds were not eating while they were in darkness. Once we were able to move them to an outdoor pen, their appetites returned to normal.



Sealions evacuation to neighboring zoos following Hurricane Katrina.

Despite the magnitude of the storm we were fortunate that we only lost two young otters, a raccoon and a flamingo chick. However, it is important to ensure that enough euthanasia solution is available in the event that animals are mortally wounded. Also, it would be prudent to hone skills for dispatching injured animals with bullets in case injectable euthanasia is not an option.

Trash - Empty all dumpsters prior to a storm (this may not always be possible). After Hurricane Katrina, there was no garbage service for many weeks so our dumpsters became very full. This created unsanitary conditions and was a haven for pests. Consider having an extra empty dumpster secured in place prior to a storm.

Empty necropsy freezers prior to hurricane season if they are not on a generator.

Disposable cups, plates and utensils are good to use if you do not want to waste time or water washing eating utensils.

Post-storm

Utilize natural "roads" for carrying supplies. For example, the Mississippi River was considered to help transport people and supplies into New Orleans after the storm. Also, a clean-up crew was brought to the Audubon Nature Institute Research Center by helicopter because the roads were impassable.

Fires in the area were a potential threat in the days after the storm. There were no local fire-fighting services or water pressure in fire hydrants to handle a fire if one had approached the zoo.

Security - This includes keeping people out and keeping animals in. Before the city was under the control of the National Guard, two of the storm riders patrolled the zoo throughout the night to ensure the safety of our team and animals. By the end of the first week, Ron found two New Orleans policemen who were willing to stay with the storm riders at the zoo. For the next hurricane season, Audubon was trying to set up a security service in advance of a storm.

Establish a “buddy-system” so that all storm riders are accounted for at the end of the day. Working in teams will help ensure the safety of the staff.

Many trees were felled after Hurricane Katrina. This resulted in a noticeable dearth of shade in animal exhibits and around the zoo. This is something that Audubon Zoo will be tackling for years to come.

Downed fences and destroyed habitats made it impossible to return some animals to their original habitats. Many animals were in their hurricane holding areas for much longer than the anticipated three days. Contingency plans for keeping animals in these “temporary” holding areas should be considered.

Creativity is important when dealing with the aftermath of a storm. For instance, with a downed fence in the eland yard, we were unable to let the eland out of their holding areas. We placed very large tree branches in the defect to create a visual barrier until we could repair the fence, which was several weeks later.

ANIMAL RESCUE: Rescuing fellow employees’ pets from nearby neighborhoods was another reality of post-storm life that we had not anticipated. Several employees were out of town when the storm hit, and their cats needed to be rescued out of their flooded homes. Also, several storm riders had left their cats in their homes thinking they would be able to return home several days after the storm. Finding a place for all of these rescued animals required creativity. Rescued cats were housed in offices and bathrooms within the animal hospital and administration area. It is important to apply flea control to all rescued animals. One cat missed the topical flea treatment, and a co-worker’s office

was infested with fleas for months after the storm!



Although rescuing these animals was a necessity and done with pleasure, it exposed the rescuers to potentially hazardous conditions. The rescuers boated through the dangerous neighborhoods and unsanitary water in order to find these animals. Also, fostering these pets took time away from caring for the Audubon Zoo’s animals.



Staff used boats to rescue pets in flood-ravaged New Orleans.

Based on our experiences with storm riders’ pets, we initiated a new strategy for the 2006 hurricane season. We found a veterinary clinic in Baton Rouge that was willing to reserve kennel space for the storm riders’ animals. The Audubon Zoo’s Animal Health Care Center provided vaccinations and micro-chipping free of charge to all storm riders’ pets prior to the start of the hurricane season. We also coordinated transportation for these animals in the event of an impending hurricane. Although we never had to implement this plan during the 2006 hurricane season, it gave the storm riders peace of mind that their personal pets would be taken care of and allowed them to focus on the task at hand. This plan also increased the number of employees willing to volunteer for the hurricane team.

Some local hospitals allowed staff to bring their family members to the hospital for the hurricane. Some of these hospitals flooded, and staff and family members were evacuated by helicopter or boat from the buildings. This can be a liability and can be distracting for those working in the aftermath of the storm. This was discouraged at the Audubon Zoo. Storm riders were encouraged to develop an evacuation plan for their family members.

Hurricane Team Relief:

It was a challenge getting the relief team into the city due to the governmental restrictions in place (mandatory evacuation post-storm). The National Guard set up road blocks at all entrances to the city and refused entry to civilians. Credentials pre-approved by local or city government agencies may prevent this problem. However, repeated discussions with local government agencies prior to the 2006 hurricane season offered no clear consensus on zoo credentials.

It is recommended that every hurricane team member work for no more than ten days straight. After this time, working under these strenuous conditions can be hazardous to a person's health and can put the rest of the team members at risk due to fatigue, illness, emotional stress, etc.

Media Relations - It is helpful to assign an outside media coordinator who is in communication with the outside coordinator. Someone from the storm rider team should fulfill this role as well. Although the government could not get help into the city, the media easily entered the city. We had numerous requests for interviews. However, due to security concerns, we did not publicly discuss our situation at the zoo until Day Six after the storm when we had better security forces. Up until this time there was a serious concern that the zoo might be vulnerable to looting if people found out that we had stores of gas, water and food. Once zoo staff safety was secured, reporters were allowed to conduct interviews with storm riders. This was perceived to be an important way to garner support for the Audubon Zoo in a very difficult time. However, the interviews usurped a large amount of time. By adding more staff to the hurricane team the following year, it was hoped that one person could be designated a media contact.

Post-storm Housing -

- This was a major problem for the Audubon Nature Institute in the weeks and months following Hurricane Katrina. For several weeks after the storm, residents of New Orleans were prohibited from entering the city.
- Many employees' homes were flooded and uninhabitable. Those homes that survived the storm did not have electricity, running water or gas services.
- The city had limited hospital and other government services (fire, police, etc)
- With neighborhoods deserted, it was slightly nerve-wracking to be the first one back on the block.
- Audubon Nature Institute rented several large recreational vehicles (RVs) that were driven to the zoo from out of state. Many employees lived in the RVs or at the zoo for months after the storm. This enabled Audubon to continue the recovery process even though the rest of the city's recovery was stalled.

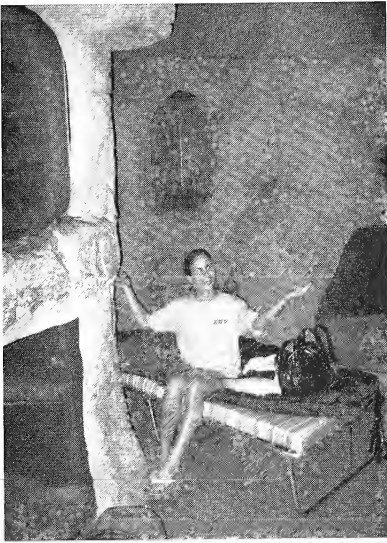
A dearth of grocery stores, banks, restaurants, gas stations, and other basic services for months after the storm made surviving in post-storm New Orleans difficult both logistically and emotionally.

The company should provide post-storm counseling, and it should be mandatory for all storm riders. The mental health of the storm riders was overlooked, and many of them suffered because of this. Only five of the original thirteen team members still work at the Audubon Zoo. Most of those who no longer work at the zoo have also left the city.

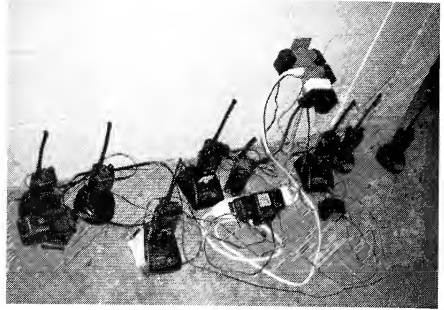
Establish and foster reciprocal relationships with nearby zoos. This proved crucial for us. The Baton Rouge, Alexandria and Houston Zoos were phenomenal in helping the Audubon Nature Institute's facilities in the weeks and months after the storm. They brought the storm riders important supplies (food/grain/hay/produce for the animals, clean clothing for storm riders, diesel fuel, etc) and offered moral support. It would be difficult for Audubon to ever fully repay the favor. The generous outpouring of support from AZA facilities and the local New Orleans population allowed Audubon's facilities to regain footing and help foster the city's own recovery process.

Keep your focus and your sense of humor; both will prove invaluable during a crisis.

Hurricane Photo Gallery



The Reptile House served as a safe haven for Storm Riders.



Keeping two-way radios charged was vital for communication



The Zoo sustained a lot of tree damage from the hurricane-force winds of Katrina.



National Guard troops helped provide security in post-Katrina New Orleans.



Levee breaches caused massive flooding in New Orleans but the Audubon Zoo was spared any serious flooding.



(All photos for this article were provided by the authors.)

(Some) Lessons Learned from Katrina

Resource	Addressed in 2005 Plan	Lesson(s) Learned	Adapted for 2006
Personnel	Team deliberately kept small (14) to expose the least staff to danger.	Not enough staff for prolonged work in extreme heat and stress.	Team enlarged to 20 to incl. 2 keepers from each animal section. Also Chef added.
Water	Stored according to plan, mostly 50 gal drums, 2- 800 gal bladders of water stored on the ground.	Open containers attract mosquitos and can otherwise be contaminated. Large animals exhaust water quickly. Difficult to move large quantities of water around zoo. Auto waterers don't work w/out power. Outside water trucks may not be able to enter thru checkpoints.	Purchased 15- 350 gal closed tanks, w/taps- easily moved with forklift and transferred around zoo as needed. Pre-arranged for water suppliers. Makeshift shower would be pre-filled, utilize ancient cisterns (once fed 1920's aquarium).
Animal Food	Enough food on-hand for most animals for 2 wks. Secured refrigerated trailer in the event Commissary storage (on generator) was lost.	Downed-browse was plentiful, used to stretch water & food. Live food (ie, crickets) and most produce were gone within 10 days.	During hurricane season, stock greater amounts of hard-to-get items. Modest effort to breed small fish and tiny insects on-grounds. Pre-order w/ produce supplier in safe zone
Human Food	MRE's, canned, fresh and stored supplies.	Salvaged food from zoos catering fridge/freezer. Appointed a cook to prepare lunch or dinner for crew. Fresh fruits & veggies not available for weeks.	Zoo catering Chef added to team. Menu planned for 20 people. Generator added for catering fridge/freezer.
Fuel	Tanks & vehicles filled prior to storm. On-site gas tank for zoo use.	Relied upon the National Guard to replenish zoo's fuel supply.	Devised portable tank to retrieve fuel from National Guard depots.
Cash	\$10,000 in small bills signed out by general curator several days before hurricane land fall. Stored money in venomous herp room.	Cash is a vital commodity in a world w/out ATMs and credit card readers. Used about \$4000, accounted for all but \$60.	Too many \$1's, consider nothing smaller than \$10's. Include an official ledger and receipt book.
Health			

Staff	Not addressed in 2005.	Toilet sanitation minimal, consider a gravity flush commode and/or "port-a-loo". Staff personal meds began to run-out. Incidences of fatigue & stress related injuries increased in subsequent weeks.	Confidential medical forms completed by each team member in case of emergency. One month of personal meds secured. Stored basic medications (ie, cough suppressant, anti-inflammatories, antibiotics) for minor medical problems. Have trained EMT on hurricane team. Post-storm counseling planned for next time.
Animal (collection)	Followed designated plan to secure certain animals indoors. Utilized all free space available, especially at the Animal Health Care Center. Prior to storm, a log of all animals (incl species, ID, location) in AHCC was made. This information was crucial in the weeks after the storm.	Animals were kept in hurricane enclosures for longer than expected. Also, some of these areas were in darkness 100% of the time.	Be ready to move animals out of hurricane areas as soon as feasible - may require mending fences, adding shadecloth, etc. Utilize natural sunlight as much as possible to maintain normal circadian rhythm.
Animal (staff pets)	Spent a great deal of time rescuing staff members' pets from flooded houses in weeks after the storm.	Rescuing pets was very worthwhile but drained already-scant resources. Some zoo staff declined being on the hurricane team due to pet responsibilities.	Coordinated safe haven for storm riders' pets at a vet clinic in Baton Rouge. Zoo provided basic vaccination, microchipping and transportation to vet clinic prior to storm. This increased the number of staff willing to be on the hurricane team.
Animal (strays)	Numerous stray animals were found and brought to the zoo for safekeeping	This is an important role the zoo can play in the aftermath of a natural disaster. However, it can be a drain on resources and put the zoo's collection animals at risk	Designate a "domestic animal-only" area (quarantine-type). Minimally treat for ectoparasites (fleas) to prevent infestation of the premises.
Access			
Keys	Partially complete key box.	Time wasted trying to identify keys and gain access.	Major effort made to bring box up-to-date for '06.
Communication			

Satellite Phone	Purchased for Ivan in 2004, but never required.	Sporadic success for zoo, aquarium's or CEO's did not work, successful for Audubon's Research Center.	Satellite phones function best in open areas of moderate elevation, researched portable antennae to deploy after storm were to pass, but never purchased.
Land-lines	Not addressed, assumed they would be down.	3rd day circa '84 line discovered working at Swamp exhibit, utilized to make initial contact w/ Houston and B.R. Zoos. Later used as main zoo phone & fax.	Added dedicated line to Reptile House (base camp for storm riders).
Zoo 2-way radios	Functioned normally but limited charger power.	Too many devices and not enough power outlets. *	Identified extra generator power, added outlets to Reptile House base.
Text (SMS)	Some team members' personal phones' text feature functioned.	Text system inexplicably functioned when few other devices were operational.	Blackberry purchased for team leader and riders' work cell phones.
Mobile phones	Some degree of function retained thru aftermath period.	Out-of-state numbers worked better than in state. Limited charging points.	Each facility was given an out-of-state number and new phone w/ text features.
Security			
Zoo Patrols	3 Team Security Guards (untrained for firearms), plus 3 Shooting Team staff (trained for firearms).	Police desperately needed elsewhere (zoo was not a priority for them). Team members began armed patrols on 3rd night after storm. Gained 2 NOPD officers on day 5. Nat'l Guard arrived on day 6.	Plan on armed patrols, but this activity may be illegal. Multi meetings w/ NOPD to offer zoo as resource for their protection, but secured no guarantees. Nat'l Guard M.O.U. attempted, but unsuccessful.
Looters	Anticipated, but no clear strategy. Team members were approached at zoo gates multiple times by outsiders asking for supplies, but no aggression occurred.	Devised outdoor "jail" out of carnivore quarantine area. Area has shade, team had water, MRE's, bug spray, chemical toilets. It was never used.	Discussed non-lethal restraints (e.g. TASEP, rubber bullets)- no clear plan.
Credentials	None	Relied on NOPD assistance to pass in and out of zoo and the city. Credentials not available.	Agricult; under whose purveyance Audubon Zoo falls. As of 06 season no clear consensus on official ID.
Documentation			
Animal Diets	Partial lists available.	Some confusion and inconsistencies in existing info.	Current diets clearly posted, available at each section. Hard copies updated prior to hurricane season.
Animal Records	AZA Safe Haven program co-founded by Audubon Registrar.	Unable to access electronic info for months after the storm, data & transfer sheets were sporadically completed for evacuated animals. It took many months after the storm to clarify transfers, etc.	Records and Daily Report system streamlined for hurricane aftermath. Planned to have a dedicated records-keeper on hurricane team. Update hard copy records annually prior to hurricane season.
Staff time	Pay schedule unclear for storm riders and staff who help prepare for the storm.	Time sheets were kept starting 10 days after storm, and days 1 thru 9 were completed retroactively.	Sheets pre-printed. Pay schedule policy established organization-wide.

Training Dangerous Animals Safely Is No Accident

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At the Speed of Light

It was just another morning at the Oklahoma City Zoo until the telephone rang on the desk of Zoo Director, Steve Wylie. Within minutes, Wylie was kneeling at the side of one of his keepers who, just moments before, had been mauled by a tapir. The injuries she had suffered threatened her very life. Nothing could have prepared Steve for what he saw. (S. Wylie, personal communication, May 17, 2006). The woman's left arm was torn off, her collarbone was broken, a lung was punctured, and she had severe lacerations across her neck as well as her thigh and leg. Her life hung in the balance. She was still in surgery in Oklahoma, when on the West Coast, the media phone calls began to come into our Public Relations office at the San Diego Zoo. The media wanted to know if we had tapirs and if so, how we cared for them, and of course, how we managed the safety of our keeper staff.

We live in the information age where news travels at the speed of light. Like Steve Wylie, any manager could have their schedule changed with the next phone call. But the point is that an accident doesn't have to happen at your facility in order to have an immediate and profound impact on your institution.

Behavior Modification is Proactive

This paper will seek to present several proactive approaches for animal behavior management programs that enhance our conservation efforts, animal welfare, employee safety and to better protect against the trauma of a variety of preventable institutional crises.

There are many important needs that compete for every manager's attention and limited time. Certainly, creating and managing a program for conditioning zoo animals in order to enhance their care is labor intensive. But, like regularly depositing money into a savings account, investing in this form of animal management is proactive and will pay huge dividends to the institution, both in enhanced animal health and welfare and with our supporting public. The creation of a well-conceived animal training program is a proactive step towards avoiding many of the predictable crises involving animal accidents in our industry.

Professional animal trainers consider the risks of working in close contact with potentially dangerous animals. The wise ones develop approaches to minimize that risk and incorporate those techniques into their training plans.

The Chemistry for Crisis and Change

What is a crisis and how does it come about? Simply put, a crisis will always occur when important needs go unmet for too long. A crisis is not always negative in its impacts. On the positive side of crisis, there is nothing more effective than a crisis for creating the environmental chemistry necessary to loosen the grip on the old way of doing things and allow for big positive changes to take place. It is when these important unmet needs intersect with a new technology which meets these needs that a paradigm shift occurs and the world changes. On the negative side of the crisis equation, the changes that result from a crisis are always accompanied by significant organizational trauma and expense.

The printing press, the electric light bulb, and more recently, the computer are examples where the intersection of important needs going unmet and an emerging new technology joined to lead to the rapid acceptance of a new way of doing things.

Perhaps there have been many other contributing factors, but in my view, the environment for crisis and ultimately change in the zoological community, came largely as a result of the premature deaths of many elephant keepers. These deaths created an environment that caused zoo directors and curators to openly wonder if there wasn't a better way of managing this important species. After this door of

traditional thinking was opened, and zoo management realized the many benefits of a new way of doing things, the technology of operant conditioning was embraced for much broader application in the zoo world.

A Paradigm Shift

Organizations are similar to biological organisms in that neither tends to make major expenditures of energy unless the painful consequence for not doing so is recognized and accepted. I experienced just such a personal paradigm shift early in my career while working at SeaWorld San Diego. In 1972, I was employed training killer whales (*Orcinus orca*). Not much was known about the behavior of killer whales because the very first live capture of a killer whale had taken place only seven years earlier. However, our animal training staff did understand the principles of operant conditioning. Kent Burgess, SeaWorld's Director of Training, held a masters degree in psychology and, earlier in his career had worked for Kellar and Marion Breland at Animal Behavior Enterprises, Inc., in Hotsprings, AR. The Brelands were graduate students of B. F. Skinner and were the first to apply the scientific principles of behavior modification with a variety of domestic and exotic animals for commercial purposes. Kent Burgess took his experience working with the Brelands and created the SeaWorld Animal Training Department.

In those days, SeaWorld was growing rapidly. We had just opened SeaWorld of Ohio and had plans for building a third park in Florida. George Millay, SeaWorld's founder and president, had further vision for a SeaWorlds of Europe and Asia. (O'Brien, T. 2005) "Shamu" the trained killer whale quickly became to SeaWorld, what Mickey Mouse was to Disneyland. SeaWorld trainers focused their creative efforts exclusively on producing new and spectacular trained behaviors for SeaWorld's increasingly elaborate animal shows. Prior to 1972, as far as I am aware, it never occurred to SeaWorld trainers to use the principles of operant conditioning that they were using with great success to train show behaviors, to facilitate routine health care and veterinary examinations. Training time was precious, and because the organization was growing, trained show behaviors were the top priority. In that same year, Congress enacted the Marine Mammal Protection Act. For the first time, Federal permits were required for the collection of marine mammals. The new laws also established standards for the captive care of all marine mammals. Certainly, the environmental chemistry of the zoological community in the United States was changing and these changes opened the opportunity for an industry-wide paradigm shift.

In the spring of 1972, one of our trained killer whales became ill. The animal's food drive was low, it was lethargic, and its breath was foul. The veterinary staff determined that a blood withdrawal was necessary. At that time, this was not a decision that was made lightly because it was an expensive and stressful undertaking for all involved. A huge crane was ordered and trainers were called and scheduled to come to work in the middle of the night. Taking a blood sample from a reluctant killer whale measuring 16 feet long and weighing over 12,000 pounds, sporting 44 three-inch long interlocking teeth could also be dangerous. Because of the safety risks for the animal and staff, Burgess felt that it would be better to perform the procedure at night, when the park was closed. The slings and equipment were made ready and the whale was isolated in the medication pool. At 0200hrs., the water in the medication pool was drained to a depth of about three feet, which allowed the whale to be comfortable but restricted movement over the bottom of the pool.

Normally, eight to ten trainers dressed in wetsuits were required for the job. Some would spread the slings and position the cradle while others would guide the whale, head first into the stretcher. After the whale was positioned in the cradle with each of its pectoral fins in the appropriate slot, the crane hoisted the animal out of the water. Of course, this wasn't always an easy task, but after the whale was in the stretcher, it got even more difficult. Killer whales are among the most intelligent animals I have ever worked with. One-trial-learning is not uncommon when shaping new behaviors with killer whales. So, it is not surprising that a whale with previous experience with the blood withdrawal procedure had learned to expect what was coming next.

As a deep diving adaptation, cetaceans can shunt blood away from their extremities to their vital organs. Through vasodilation and constriction, whales and dolphins can voluntarily control the blood flow in their extremities. The veterinarians elected to take blood samples from the pectoral flippers. The target site was in the hard, fleshy area between the bones, and only the most sensitive and skilled human hands could feel the proper location of the blood vessels there. Compounding matters, the pectoral flippers on killer whales are completely jet black, making it difficult or impossible

to see the blood vessels on both the dorsal and ventral sides. So, the animal care staff faced a very large, reluctant carnivore, that was not feeling well and that, through prior learning, probably knew what was coming next. It may not come as a surprise that we were unsuccessful collecting the blood sample. In fact, it is no exaggeration to say that we were usually more successful getting blood samples from the trainers than we were an ailing killer whale.

One morning, after the unsuccessful attempted blood withdrawal the night before, Dr. Lanny Cornell approached me. At that time, Dr. Cornell was SeaWorld's head of veterinary medicine. Dr. Cornell was new to SeaWorld and had been hired away from our nearest competitor, Marineland of the Pacific, about 100 miles North of San Diego. When Dr. Cornell approached me, a group of trainers was standing around and complaining about being cold and wet and our failure to obtain a blood sample a few hours earlier. Dr. Cornell abruptly changed the subject and mused out loud how amazed he was at our ability to train the killer whales to perform various behaviors so reliably for the shows. He noted that we had successfully trained Shamu to leap 20 feet in the air to touch its rostrum to a foam target in exchange for a few pounds of fish. Puffing up with pride at his observation, we all agreed that, in fact, we really were something special! Cornell had skillfully baited and set the hook, and saw that the fish had taken the bait. Just to be certain, he then offered that he was further amazed that we had never considered using this wonderful technology to train the whale to voluntarily accept blood withdrawal. Punching across the goal line for a touchdown, Cornell added, "Like the trainers do at Marineland". At the intersection of a new thought and of injured pride, a mini crisis had just occurred and a paradigm shift was about to take place.

As far as I am aware, this was the first time any of the SeaWorld trainers had considered using the tool of operant conditioning for any other purpose than training behaviors for the shows. In an instant, the value of training a whale to voluntarily allow blood collection was obvious and proved immensely practical. If this behavior was trained, we could request the behavior anytime - no more coming in at midnight, no more getting cold and wet while wrestling a reluctant killer whale into a stretcher, no more crane rentals. There really was no downside to at least trying to condition this behavior. Although we had never before trained an animal to accept blood collection, we understood the technology and used it to develop a systematic plan for training the behavior. Within the space of seven days, we had trained our first killer whale to roll over on command, present the ventral underside of its tail flukes (which are white and the veins stand out like a road map), and hold steady while a butterfly catheter was inserted into a vessel and blood withdrawn. It was so easy. We were skillfully led by Dr. Cornell, to the intersection of crisis (the old way of doing things) and technology (a way of doing things that is more productive), and SeaWorld animal husbandry practices were never again the same.

More than 30 years have passed since then, and it is difficult to imagine that marine mammal care was ever managed any other way, but it was. Today, dozens of routine veterinary procedures, including voluntary blood collection, ultrasonography, palpation, crating or beaching, semen collection, artificial insemination, as well as many others, are standard operating procedure in the progressive marine park. Best of all, the application of these techniques is no longer limited to marine mammals. Animal care professionals have begun to experiment with applying operant conditioning to solve management problems with a huge variety of animals including sea turtles, nurse sharks, tropical fishes, and water snakes.

Free and Protected Contact

Virtually all human/animal interactions take place in an environment of either free or protected contact. In 1991, the term, "protected contact" was coined by consultants to the San Diego Zoo's Wild Animal Park, Tim Desmond and Gail Laule (Desmond, T. & Laule, G., 1991). The use of the term was offered as a way to describe a new style of elephant management that we were working to develop in San Diego, so I adopted it on behalf of our organization. I deeply regret that there is still much confusion regarding protected contact and what it is and is not. Let's examine the two environments where animal training takes place.

During a show at SeaWorld, a trainer swimming with a killer whale in a pool 30 feet deep and containing 6,000,000 gallons of seawater is interacting in a "free contact" environment. Both the whale and human have unrestricted access to each other. Another example of free contact is when a trainer at the Ringling Brothers Barnum and Bailey Circus, is moving in and around a group of elephants with the elephant's full acceptance. The safe operation of a free contact training environment relies on a well-defined and skillfully operated program for behavior management. By contrast to

the free contact environment, a technician in a research laboratory is training a primate through the bars of a stainless steel door for veinipuncture and blood withdrawal and is working in a protected contact environment. A physical barrier creates a separation of space between human and animal.

So, in the above scenarios, which trainer is safest? The protected contact environment is certainly safer than free contact. Or is it? Unfortunately, many zoo directors and curators seem to think that protected contact is always the safer form of management. In my view, the **key word** in either the free contact or protected contact management systems is the word "contact". It is important to recognize that in all three of the above scenarios, contact between an animal and a human is possible. Of course, whenever contact is possible, so too is the possibility for serious injury or worse. In the above example of protected contact with a primate, the ape is a host to the herpes B virus. A simple scratch from an ape hosting this virus could prove fatal for the human caretaker. So, the protected contact scenario could be at least as dangerous or even more dangerous, as either of the free contact examples cited above. An elephant being managed in protected contact could certainly be as dangerous as an elephant in the free contact environment. If the trainer is standing within reach of the elephant's trunk, the protective barrier will be of little significance if the elephant has determined that it is going to grab the trainer. So the professional manager is responsible for understanding the work environment and for developing the vision and creating the structure for their animal management programs that are necessary to ensure the safety of the human and animal participants.

The risk to safety that I inadvertently created by agreeing to use the term "protected contact" is that the term may create in the trainer's mind a false sense of security. Keepers may not clearly understand that if contact with the animal is possible, then they should view working with that animal just as they might when operating in a free contact environment. Program managers must recognize this vulnerability and create operating protocols and policies that protect against this potentially dangerous misconception.

In my opinion, a critically important emphasis regarding the free or protected contact training environment has been misplaced. In either situation, the correct emphasis should be focused on the motivation and attitude of the animal that is interacting with the trainer. Whether operating in a free or protected contact environment, through operant conditioning, skilled trainers can and do shape much safer behavioral attitude traits in the animals they work closely with. Attitude reinforcement is truly an elegant application of the power of operant conditioning to shape future behavior. Certainly, managers of businesses that employ workers should understand and employ this principle just as the best animal trainers do with their animals.

Motivation, Attitude and Aggression

California sea lions (*Zalophus californianus*) have been trained to perform shows well in excess of 100 years. Behaviorally, sea lions are considered a tournament species. In June of every year, the males stake out breeding areas on the beach and aggressively defend their territories and harems against the intrusion of all other male sea lions. Certain key body postures are always present when the males joust. All sea lions bunch and harden the muscles of their neck to better protect themselves against the bites of another. The vibrissae extend forward to give the bull close-in sensory information during combat without exposing the eyes to injury. When working with sea lions in free or protected contact, wise trainers reinforce a class of "attitude" behaviors that are known to be incompatible with these aggressive postures. The experienced trainer never misses an opportunity to reward a sea lion for relaxed breathing; vibrissae that are relaxed and flat against the sea lion's face; and for a long, smooth and relaxed neck posture. An experienced trainer considers the type of animal (s)he is working with and its natural history and, in addition to conditioning the target behavior, also takes the opportunity to reward displays of attitude that are incompatible with aggression.

Police dogs are a good example of an animal whose behavior may be purposely shaped for aggression. In this example, aggression is a carefully controlled behavior. It is important to recognize that aggression is a learned behavior and virtually all animals have some degree of aggressive behaviors in their repertoire. Like any behavior, aggression can be modified. If the consequence of aggression is reinforcement, more aggressive behavior will follow. Practice makes perfect. So it follows that if postures and attitudes that are associated with aggressive actions are not only not rewarded, but behaviors that are incompatible with these postures and attitudes are rewarded, over time, a more relaxed and less aggressive animal will be the result. Regardless of the species being trained, "attitude reinforcement" should be a primary component in any program for the conditioning of animals. The single exception to this rule would be in the case where an animal is being specifically conditioned for release back to the wild.

Psychologists, ethologists and animal trainers have developed six important observations regarding aggression in animals. The following helpful list was compiled by Turner, T. & Thompkins, C. (1990), In Ramirez, K (Ed.) (1999), specifically for working with marine mammals, but I have found that their observations also hold true for terrestrial animals as well.

- Animals that have the opportunity to aggress will do so more often.
- The use of punishment or aversive control will cause aggression.
- Aggression can be shaped by accidental or purposed reinforcement.
- Animals may initially respond more favorably to a consistent environment, so radical changes should be conditioned deliberately and positively.
- An animal that is food deprived will aggress more readily.
- Most all animals have some degree of aggressive repertoire.

To work more safely around wild animals, it is important to recognize those situations when aggression is most likely to occur. A sick or injured animal or one that is startled or feels cornered is a dangerous animal. The drive to reproduce represents a significant class of animal behaviors. Increased levels of hormones can serve to change the training environment without the trainer's awareness. Breeding season, rut, musth or even the unwitting interruption of courtship can lead to aggression that spills over into training sessions. The use of moderate or greater aversive methods to shape or maintain behavioral control has also proven to increase the likelihood of aggressive behavior directed towards trainers. In today's training environment the use of positive reinforcement, attitude reinforcement, and building a trust relationship with the animal have gone a long way towards improved safety for animal and trainer alike.

It takes energy for any animal to aggress. Based on my experience, one of the primary benefits of a protected contact training environment for elephant handling is that participation on the elephant's part is totally voluntary. The animal can elect to walk away from a training session at any time with no negative consequence (Priest, G. 1992). So, the frustration for the animal that can sometimes be associated with the problem-solving process of animal training has an important energy saving outlet besides aggression. Because serious injury to a human might result, voluntary compliance is not possible in every training circumstance (e.g., large cats on leash, free contact elephant management,); however, although I have only anecdotal data to support this belief, I believe that training environments that can support voluntary cooperation by the animal, where the animal has learned that it can terminate the session at will, are significantly safer for the trainers. In situations where we work with large carnivores and leashes, we routinely ask the animal to perform a simple stationing behavior prior to the trainer entering the animal's environment. The performance of a stationing behavior works well to indicate the animal's willingness to cooperate with the trainer in a training session. Of course, the technique is not foolproof, but in our experience, it seems to work very well and is a prudent precaution that we take.

Skilled trainers typically employ three primary behavioral strategies for dealing with aggression. Over the years, trainers have learned to reduce aggressive behavior by differentially reinforcing behaviors other than aggression, also known as (DRO). A second and equally important strategy is the differential reinforcement of behaviors that are incompatible with the aggressive behavior (DRI). A well-known example of the DRI strategy with elephants is when the animal has been trained to perform the "trunk up" and "foot up" behaviors. The elephant holding its trunk curled up over its head is incompatible with using the trunk to strike out, and, lifting its foot off the ground is incompatible with the performance of a charge behavior. In this way, trained behaviors with a long reinforcement history can be used as an alternative to aggression. The third and most important strategy for dealing with aggression is this: the trainer must understand the animal's natural history and within that context, skillfully work to prevent aggression from occurring in the first place. Implementing these strategies is proactive training with a long-term view and requires a long-term commitment to maintain. It is wise to remember that where aggression is concerned, practice makes perfect and aggression perfected, is coin of the realm for the local media's leading story.

Questions Before Training an Unfamiliar Species Begins

In 1990, at the American Association of Zoo Keepers (AAZK) conference in New Orleans, I presented the following questions that a keeper should ask in order to safely work closely with a given animal species. (Priest, G. 1990). When planning a program, it is vitally important to first assess how the animal might interact with and exploit its own environment in nature. The questions progress from

the macro to micro levels. A survey of the animal's natural history will yield clues about how to work safely around it and will provide insight into how it might learn most efficiently. A staff library, professional list-serves, membership in professional organizations like the Animal Behavior Management Alliance, (ABMA), American Association of Zoo Keepers, (AAZK), or the International Marine Animal Trainer Association, (IMATA) are all wonderful resources for obtaining information about behavior modification.

At the macro behavioral level, the following questions should be answered:

- How does the species exploit and interact with its environment?
- Does it actively hunt its food or is it passive?
- Where is the species found on the food chain?
- What are the species' predators? And, what if any, behavioral positions or postures a trainer might assume, might trigger a fight or flight reaction?
- Is it a carnivore, omnivore, herbivore or other?
- What are the species' primary sensory capabilities?

Once answers to the above questions are understood, the focus narrows to species-specific behavioral questions:

- Is the species social or solitary by nature?
- Is there a dominance hierarchy in the social structure of the particular species?
- Is it an aggressive, tournament species?
- When does the species become sexually mature?
- What is the reproductive cycle of the species? Is it seasonal, or triggered otherwise?
- What are postures typical of the species when relaxed, excited, agitated, aggressive?

Drilling down to the micro behavioral level, the focus sharpens to the specific animal being and its individual behavioral characteristics and idiosyncrasies.

- Is the animal tractable?
- Does the animal have any physical limitations? Limiting factors could include: age, sex, sexual state, size, agility, health, and sensory loss.
- Has the animal shown any preference for a male/female keeper orientation?
- Does the animal have any preferred foods, which could be delivered as reinforcements for desired behavioral responses?

In addition to these questions, experienced trainers generally agree on the following across-the-board rules, which are reviewed prior to beginning any program of behavior modification with an unfamiliar species.

- Never ask an animal for the performance of a behavior that, its own natural environment, would not also require of it.
- Have a clearly established goal at the outset, and a clear plan in mind, that details how you intend to encourage the animal to respond towards your target behavior. Behavior is shaped by the differential reinforcement of successive approximations, which naturally lead towards the target behavior.
- Trainer consistency (individually and in multiple trainer work environments), is critical for success. Consistency between keepers, their method, reinforcements, and goals, are of primary importance for the success of any behavior modification project. Keep detailed records. Inconsistency will result in confusion and frustration for the animal and a protracted project.
- Establish a training environment and method, which establishes for the animal the greatest opportunity for success. Think through the plan. Establish clear parameters, which all participants agree to follow.
- Animal behavior is dynamic and fluid; be prepared to modify your plan to allow for changes in the way the animal responds to the conditioning process.

Reporting Injuries

All animals have the ability to protect themselves. It is natural to expect that people working in very close contact with animals on a daily basis will occasionally be injured. In general, the business of training animals seems to attract people with strong personalities. I have found that most animal trainers are hard working, dedicated, animal lovers who are self assured, self-reliant, self-starters. There is little they fear and almost nothing they believe they cannot accomplish. I have also found that these same characteristics can collide with certain safety policies. Trainers almost uniformly

believe that the accident will not happen to them or if it does, that the scratch is, "not that bad". Perhaps it is this very psychology that permits trainers to interact with much larger, more powerful, and potentially dangerous animals, with such unflinching self-assurance. In fact, I believe if they did not possess this psychological mechanism, it is likely that they would telegraph fear to the animal resulting in the possible compromising of their safety.

One day I unexpectedly learned that one of my trainers had been injured several years earlier while working with a snow leopard (*Uncia uncia*). I was shocked to learn of the accident so many years later. But, because no bones were broken and no stitches required (in the trainer's opinion), the injury and circumstances were simply not reported. However, the injury was sufficient to leave several large permanent scars on the employee's leg. This was a defining moment, and I realized that I had a problem. For a short time I implemented my "Blood Lost" policy, but soon discovered that no two trainers will agree over the amount of blood that a trainer must lose before an injury should be properly reported! As a program manager, for a variety of good reasons, I wanted to know about every trainer injury. It sounds odd, but with my trainers, I discovered that blood lost was always a matter of very subjective measurement. So, I then developed the "Broken Skin" policy. We can all agree on what a break in the skin looks like. So, now, every trainer who suffers a break in the skin, without regard to any visible blood or blood loss, is required to report to the medic for treatment and to fill out an incident report. I confess that no one (including me) likes the policy very much, because even the smallest scratch must be reported and that takes time away from working with the animals. But, I now have a record of every accident that involves an interaction with a trained animal and nothing else that I have tried has produced that result.

Initially, my trainers were concerned that the number of incident reports in their personnel file might somehow be used against them. I explained that this was not my intent; however, because safely working with potentially dangerous animals is an important goal, I do believe that for a professional animal trainer, excessive injuries could indicate an employee performance issue. The good news is that in several years of using this system, I have noticed that some employees are injured more frequently than others, but the information is used as a coaching tool and has never resulted in more than a mention during a performance review.

Venomous and Other Dangerous Reptiles

Many zoological institutions maintain dangerous and/or venomous reptiles in their collections. From the captive reptile's point of view there are only three possibilities concerning the opening of the enclosure door. #1 - The keeper may be cleaning the exhibit and therefore disturbing the animal's environment creating a behavioral environment for alarm and self-defense. #2 - The keeper may be placing food in the exhibit, triggering appetitive behaviors. Or, #3 - The keeper may need to weigh or handle the reptile for some veterinary procedure. So, for a captive reptile, virtually every time the exhibit doors open, at a minimum, there will be a disturbance that will likely alarm or excite the animal. An alarmed or excited animal is a potentially dangerous animal.

Minimizing the disturbances caused by maintaining captive reptiles and lessening the risks to the keeper are wonderful goals. Now, keepers at several progressive institutions are actually conditioning certain highly venomous snakes like cobras and mambas and other dangerous reptiles like the crocodilians and Komodo dragons to voluntarily shift from one enclosure to another in exchange for a reward. This is certainly an elegant and practical solution to a problem in animal management.

For many years, reptiles were simply dismissed as being un-trainable. This is absolutely not the case. True, reptiles have slower metabolic rates than do mammals, but they can be trained and do retain that training in their memory. To me, training reptiles is the most exciting new frontier in animal behavior management. It is currently on the cutting edge of progressive programs.

A National Concern

Earlier, at the beginning of this paper, I cautioned that an accident does not have to occur at your institution to have a direct and profound impact on you. Due to important conservation, animal management, and animal welfare goals, our employees are now working in closer proximity to large potentially dangerous animals. Unfortunately, just like my never having learned how to program a VCR, many managers now find themselves in a situation where they manage employees with an interest and background in a technology that the manager may have little practical experience with, or even understand very well. Over time, this vulnerability will disappear (as it did for me with the development of digital video disks). Unlike the VCR, the technology of behavior modification is

here to stay. The principles that underpin behavior modification form the basis of a kind of universal language, which every creature, from protozoa to whales, seems to respond to. So, these managers must either learn the basics of behavior modification or retire. It is likely that for the next few decades, the zoological industry will be vulnerable to ill-conceived or poorly-managed animal training programs while the paradigm shift continues to take place.

One Model for Trainer Certification

In 1991, the unthinkable happened at the San Diego Zoo's Wild Animal Park. Pam Orsi, one of the Park's elephant keepers was working in a free contact environment with one of the Asian elephants, when something went horribly wrong. We believe that Pam had asked an elephant to lie down. As the elephant was getting back up, somehow Pam lost her footing and the animal stepped on her. Pam died a short time later. According to Dave Matthias, the Zoological Society of San Diego's director of risk management, the first documents the investigators from the Occupational Safety Health Agency asked for were those that would indicate Orsi's qualifications and training for the position she held as an elephant keeper. (Dave Matthias, May 25, 2006, personal communication).

In a multiple trainer work environment, there is no practice more basic to a safe workplace than creating a plan for the consistent application of the principles of behavior modification between trainers. Almost all trainers work in a multiple trainer environment.

A huge change is taking place in our industry. In the last decade, there has been almost universal acceptance of the value of animal training in the zoological setting. For those new to this idea, this acceptance has brought with it some significant organizational challenges. At the Zoological Society of San Diego (ZSSD) for example, during the last 15 years, the Animal Behavior Management department has grown from a single individual (me), to about 60 animal trainers who work in different divisions at either the Zoo or Wild Animal Park. Dozens of other zoos have created animal training positions to help direct the training of collection animals.

It has been said that there are probably a hundred ways to train any given behavior. Behavior is plastic. If this were not so, behavior modification would not work. The best approach varies from one species to another and from one individual animal to another. Of course, with this much variability on the creative side of training, the consistent application of the principles of behavior modification between 60 individuals operating at two campuses located 35 miles apart and in over a dozen work-areas is a basic problem that somehow I had to reckon with. This issue is not just a "large institution" problem. Consistency and discrimination are the same problems faced every day by trainers working in a single work area.

Several years ago, trainer and author Ken Ramirez led a group that looked into the idea of a national trainer certification. This group discovered that such a program through the International Marine Animal Trainers Association, (IMATA), could present some potential liability issues for the organization that were best avoided. As an alternative, the group settled on identifying some key components that each facility should ideally have in place in order to create a professional environment for animal training programs in a multiple-trainer work environment. The group suggested that by adopting these broad guidelines, a facility could be "certified" as having provided the environmental components necessary to better ensure the operation of a safer and more successful training program. (Ramirez, K. 2001)

In 2002, as my department continued to expand, I needed to develop a method for dealing with the problem of establishing and maintaining consistency of technique between my trainers working in different locations with many different animals. In my search, I decided to look at how other technical professions went about certifying their own professional practitioners. I discussed staff training with police and fire departments as well as other animal training programs. At about this same time, I had just completed flight training and had earned my private pilot's license. As I applied my work problem to the template for pilot training that I had just completed, I discovered a certification model that fits amazingly well with animal training.

The skills used to pilot an airplane are similar to animal training in that both require significant foundation in a field of technical knowledge and the development of a set of physical skills and timing to be used in concert with that technical knowledge. Training animals and flying an airplane take place in an inherently dynamic and sometimes dangerous environment. Pilots and animal trainers are intelligent and highly motivated people. So, I discovered that the model developed by

the Federal Aviation Administration (FAA) for the licensing of private pilots meets exactly the same requirements that we might have for teaching our trainers to apply technique, to better ensure consistency and operational safety, and to hone a set of physical skills.

Similar to a three-legged stool, the FAA's program has three primary components. The applicant must; #1 pass a written examination, #2 pass an oral examination, #3 and demonstrate the basic set of physical skills that are required to safely pilot an airplane.

In order to earn a private pilot's license, a pilot "wanna-be" must first pass a written examination with 70% or better. The FAA provides over 1,000 possible questions with multiple-choice answers. The actual knowledge test features 100 multiple-choice questions randomly selected from each of the key knowledge areas, from the deeper 1,000 question data pool. The test is not an open book test, but every one of the 1,000 possible questions and its correct answers is freely available to every applicant for advance study. It is important to recognize that the FAA's goal is to use the test to demonstrate the applicant's retention of critically important aeronautical information. The knowledge test and flight training can occur simultaneously, but the test must be taken and passed before the applicant is authorized to proceed to the next two stages of certification. Under the watchful eyes of a certified flight instructor, the applicant must develop and be able to demonstrate skills to take off, land, navigate, and communicate with air traffic control.

During the last phase of certification, an FAA inspector will give the applicant an oral examination covering a broad range of aeronautical knowledge topics. During the "Orals", the examiner will pay special attention to the questions in key knowledge areas that the applicant missed on the written examination. The examiner can ask any question, about any topic covered in the training and in any order.

Only after the FAA examiner is completely satisfied that the applicant has the required level of knowledge do the examiner and applicant take to the skies. It is in the air that the applicant must demonstrate, to the examiner's satisfaction, that (s)he has developed the skills necessary to safely function as pilot in command of an aircraft. The goal of this entire process is to insure, to the greatest extent possible, the safety of the pilot, passengers and at least as importantly, the rest of us on the ground! Of course, accidents still do happen because people are not perfect. But over many years of development, the FAA's pilot training and certification process has been refined and has proven to enhance safety in a potentially dangerous environment.

Surprisingly, securing approvals to develop and implement this program from our human resources and legal departments was much easier than I expected. In fact, they were enthusiastic about any idea that had the potential to create a safer work place. Workers compensation insurance costs are sky-high (pun intended) in California. The feeling was that anything we could do to increase safety in the workplace and lower our insurance costs was worth the effort. Our trainers belong to the Teamsters Labor Union. Because the certification program is voluntary, is paid for by the employer, and designed to enhance employee safety, the Union would have no objections. There was, however, one legal caveat to the ZSSD acceptance of the idea. The legal department wanted to insure that the certification was only for work within the ZSSD. Just like earning a college degree, trainers who become "certified" through our program would certainly be expected to cite this achievement on their resumé's, but the legal department did not want the trainers to advertise their certification in a private venture while still employed by the ZSSD, that might create liability for the ZSSD. Considering today's litigious society, this requirement seemed both reasonable and prudent.

Like the FAA's program, we have developed a pool of several hundred questions with multiple-choice answers that trainers will study in advance. The written examination is made up of 100 random questions taken from the larger question data pool. For text books, I provide trainers with their own copy of Karen Pryor's, *Don't Shoot the Dog* and Dr. Sophia Yin's, *How to Behave So Your Dog Behaves*. Both of these books are good sources of information for terms, definitions and applications of technique. I have also provided each trainer with a copy of *Animal Training* by Ken Ramirez, as an additional resource. In addition, we have developed a 30 page internal document entitled, *Animal Presentation Standards*. The document details the organization's curatorial and veterinary staff expectations for how animals are trained, cared for, presented and transported, as well as many internal policies, protocols and procedures.

Unlike the FAA written test, which requires a passing score of 70% or better, I require a score of

80% or better to pass our written test. I made this decision in consideration of three facts about our employees. First, what is presented on our written test is not new information. Second, positions in our field are so highly sought after, that most entry-level employees today come pre-qualified with degrees in psychology, biology or zoology. Lastly, in San Diego, in addition to our new trainer's academic qualifications, we have found that most of our applicants come to us with experience gained at other facilities. As an employer with a world-class reputation, we are in the fortunate position of being able to be very selective about whom we hire.

All trainers come into our department understanding that they are not being hired as a sea lion trainer, bird trainer, or a big cat trainer. They are being hired as an animal trainer. While they might have a passion for working with a particular taxonomic group, I am most impressed when an applicant is primarily interested in the science of animal learning. Once a trainer is hired into the department, we try to place the trainer where their passions lie, because placing people in areas where their passion can be explored is just good business. However, because we never know where the next opportunity will come from or what species we might be working with, hiring trainers who are interested first in the science of animal learning is very important to our operation and our success as a department.

Animal training managers, the area leads, and the more experienced trainers serve as mentors to the newer animal trainers in each area. To the employee seeking certification, these more experienced people are the equivalent of a student pilot's flight instructor.

The four Animal training managers in my department serve in a capacity similar to the FAA flight examiner. They conduct extensive oral examinations and review the demonstration of each applicant's practical skills required for certification.

At our institution the job title "animal trainer" is actually a job classification. It does not necessarily refer to an employee having successfully passed the certification process. All line employees in my department are "animal trainers" by job classification whether they were just hired or have 30 years experience. Within that classification are found different pay grades based on hours of service with the organization in that classification. So, the Animal Trainer Certification Program falls outside the boundaries of our Human Resource department's definition. Trainer Certification is simply advanced training.

No person is made to learn to fly an airplane. Earning a private pilot's license is both voluntary and expensive! In our program, trainer certification will be voluntary as well. I believe that most animal trainers are intelligent, well-educated, creative, self-motivated, out-going, hard-working people. I have found that the job selects for these particular qualities and the competition to enter the field ensures that employers can select the best of the best. This program will not be mandatory because I know that my trainers will be eager for the instruction. The extra effort the trainer goes to will be recognized with a plaque awarded during department meetings and noted on their annual performance evaluation. While not mandatory, becoming certified will be important to the trainer's advancement within the department.

White Papers

A White Paper is a brief and sharply focused document that is written in advance on a particular topic or issue that the organization might face. A White Paper develops an organization's policies and position relative to an event. The Paper quickly identifies the problems and concerns regarding the issue. The value of the White Paper is that it is written in advance of something happening at a time when discussions and thoughtful attention can be given to mega themes and organizational strategies. A crisis is no time to be wondering about how your organization will respond to the media and what its position should be relative to an event that has occurred and is being covered by the news media.

The ZSSD has developed white papers on a number of the topics including; elephant management, animal training and presenting trained animals from our collection in educational shows. These areas were selected because we know that they generally take place in a public setting and because working closely with exotic animals can be dangerous. In addition, the ZSSD operates two very high-profile institutions in the San Diego area. In San Diego, there are multiple local television, radio and print media nearby, and in the event of any incident, we anticipate media involvement. We also understand that our members, public and others with perhaps less benign motivations, will

want to know that we have carefully considered, what, why and how we decided to manage the animals in our collection in a particular way. White papers are good, proactive management and are certain to pay dividends for the time invested in their development. Like life insurance, white papers help to provide organizational leaders with peace of mind through advance planning. Regardless of where an accident with an animal may take place, a white paper will be an invaluable tool when the organization requires the information in response to questions from the press.

In Conclusion

Individuals involved in careers in animal science, have embarked on an exciting voyage that today, as never before, has the sole purpose of preserving as much of the planet's biological diversity as possible. On this voyage, we have seen many changes in the way we exhibit and care for our animals. We have already journeyed far, but have, just now, come to a place where we have the tools to care for our animal's psychological, as well as their physical, well-being. For those willing to accept the challenge, we are entering an exciting era in the care, management, and exhibition of captive exotic animals.

Disclaimer

Working in close proximity with wild animals is full of risks that can and should be managed. The thoughts expressed in this paper are presented in order to enhance the safety and welfare of employees of zoological institutions. Each institution must be responsible for carefully considering the decisions necessary to develop a program within the framework of the organization's needs and culture. This paper is not intended as a "how to" guide for animal training. Author, Gary Priest and the ZSSD assume no responsibility for the application of any concept or technique presented in this paper.

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Big Cat Internships Available

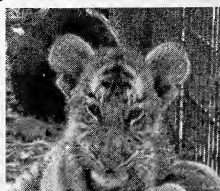
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Firearms Use and Training in AZA Institutions

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Introduction

Like many other institutions, Zoo New England has been re-examining our safety programs. Through this process we have been looking closely at one particular part of our dangerous animal response training- the use of deadly force. From the collective experience of our staff we knew there was considerable variation in the approach individual facilities take with this issue. Some additional investigation confirmed this, and also showed many other institutions had questions of their own. We created this survey to document the current state of firearms use and training in AZA institutions.

Since initiating this project, we discovered two similar surveys had been done previously. Baker (1996) did a survey of crisis response in North American zoos that was originally published in *Animal Keepers' Forum*, and reprinted in the AAZK's *Resources for Crisis Management in Zoos and Other Animal Care Facilities* (Chan, *et al.*, 1999). Jeff Cook of the Birmingham Zoo did a smaller scale survey of firearms in 1994, however the results were not published.

The Zoo New England survey was created to document how many AZA institutions maintain firearms and what types they possess. It examines who is authorized to use firearms and in what situations. It also considers the training and qualification processes that various programs use. We have examined how emergency response teams are organized and deployed. We have also explored some the legal issues surrounding this topic. We believe that the information we have collected will help other institutions as they re-evaluate their own firearms response and training.

The survey was originally distributed by e-mail through the AZA Director's listserv. There were some problems getting the survey file attachment to work, but we finally got a usable copy through. The number of requests for materials following the first failed attempt to send the survey showed that there was considerable interest in this topic. Six surveys were returned by e-mail the first day a usable copy went out. There was a follow-up e-mail request and a final surface mail request.

We received 123 responses from 191 institutions (including two Canadian, non-AZA), for a total survey response of 64%. It is evident that many institutions are reviewing their firearms policies at this time, however, planned changes were not counted as current conditions. Not all respondents answered every question. Some responses required interpretation to standardize answers for comparison. The information returned was summarized in a database. Most results are presented as a percentage of the total number of institutions responding to a particular question. All percentages are rounded to the nearest whole number.

FIREARMS USE SURVEY RESULTS

1. Does your institution currently maintain firearms for dangerous animal situations?

Ninety-four of the 123 respondents (76%) reported that their institutions maintained firearms.

If no, why not?

Twenty-two of the 29 respondents that reported having no firearms indicated that they did not have any dangerous animals that would warrant the need for deadly force. This makes sense, as most of these are aquariums or aviaries. At least three of these institutions have animals in their collections that are considered dangerous animals elsewhere, including, but not limited to, baboons, small carnivores and crocodiles. Six zoos (5 %) rely solely on local law enforcement for firearms support. Two of these six zoos indicated that they made this decision because they did not feel it was worth the liability of arming their staff. One zoo has dangerous animals, no firearms and no arrangement with the local law enforcement, but is working to change this. This information is summarized below.

2. What steps do you take to ensure compliance with local or state firearms regulations?

Eighty-six institutions provided this information. Fourteen (16%) reported that they had no regulations to consider. Fifty-seven (66%) reported working with their local law enforcement department. Five zoos have some form of documentation from their police department or governing authority authorizing them to have and discharge firearms. Six zoos reported that their staff had to acquire permits from local, state or federal authorities. This information is summarized below.

Method	# of responses	% of responses
no regulations	14	16
work with local law enforcement	57	66
permit required	6	7
documented authorization	5	6
have in-house police department	2	2
through training programs	2	2
Total number of responses	86	

3. Where and how are your firearms stored?

Eighty-eight zoos reported how and where their firearms were stored. There was a range of one to six separate locations. Fifty-three (60%) have all of their weapons stored in one location. All zoos reported that their firearms were secured in a locked room or cabinet, often behind multiple locks. At least two have either weapons or keys stored behind glass for emergency access. Two institutions reported very limited access to their weapons while two others make the weapons accessible to all staff members. Three institutions reported using trigger locks. Four institutions reported that their weapons were stored loaded (with empty chambers), while three reported that their ammunition was stored separately as required by local law.

Number of storage locations at the zoo	# of zoos	% of responses
1	53	60
2	17	19
3	6	7
4	5	6
5	5	6
6	2	2
total responses	88	

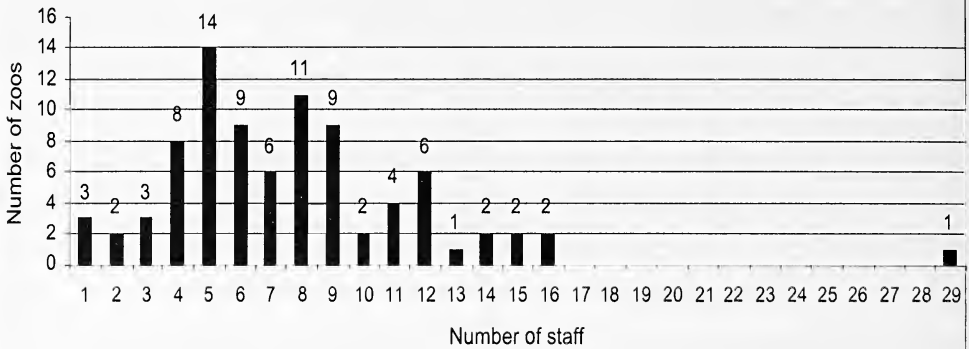
One hundred and two specific locations were described. Seventy-seven percent were administrative offices, animal service areas or veterinary clinics. Some zoos reported more than one location. Seven of the nine vehicles are zoo security patrol vehicles. These storage locations are detailed as follows.

4. Who is authorized to use the firearms at your facility? Please list by job title and years of firearms experience.

Ninety-two zoos provided a list of authorized individuals. The reported range was from 1 to 29 authorized personnel, with an overall average of 7.62 persons authorized per institution. This average is a low estimate. Because some institutions listed a group of individuals (security officers, for instance), I could not include them because I did not have an accurate total number.

Storage area	# of responses	% of responses
animal area	27	26
vet clinic	22	22
admin office	30	29
security office	11	11
vehicle	9	9
commissary	3	3
total responses	102	

Total number of authorized staff

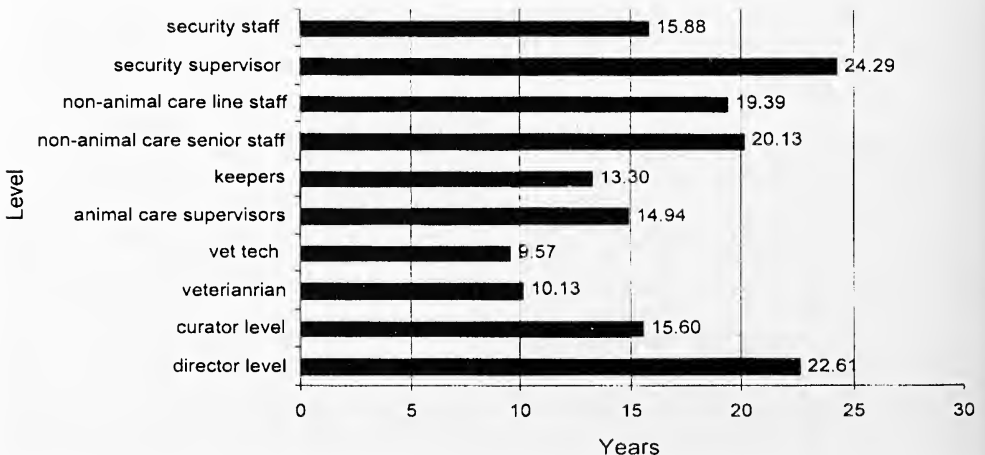


I interpreted the various titles and assigned them to categories as summarized below.

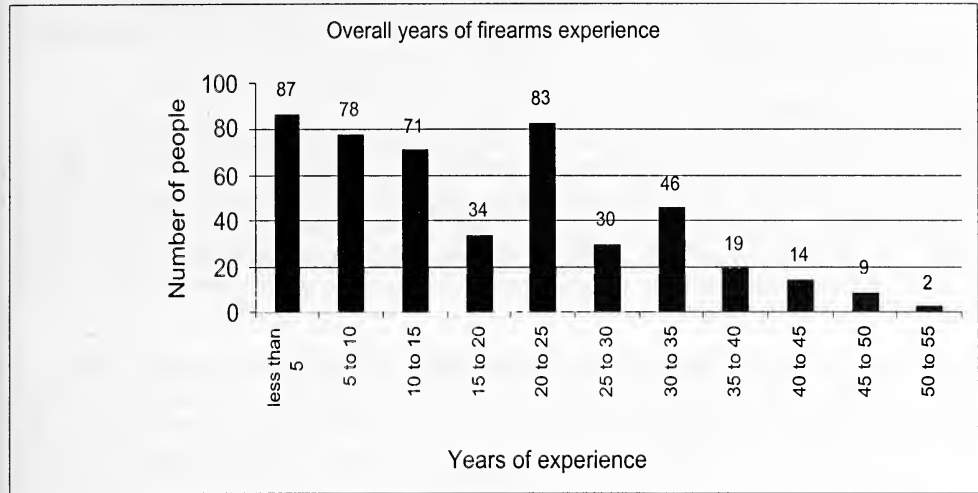
Level of authorized person	# of responses	% of total	Average #/ institution
Director	35	5	1.00
Curator	133	20	2.05
Veterinarian	45	7	1.50
Vet. Technician	7	1	1.00
Animal Care Supervisor	163	25	3.33
Animal Keeper	149	23	3.55
Non-Animal Care Senior Staff	57	9	1.50
Non-Animal Care Line Staff	27	4	1.93
Security Supervisor	22	3	1.57
Security Staff	17	3	2.43
total authorized	655	100	7.62

We received experience data for 473 of these people. Ten specifically mentioned military experience, and three mentioned hunting experience. One zoo only gave the years of zoo-related experience. I interpreted these responses as accurately as I could. For example, a response of 20-plus years was entered as 20. This yielded an average time of 15.98 years firearms experience per person. This estimate is also probably a lower than the actual figure. The average years of experience by level is summarized in the next graph.

Average Years Experience by Level



Overall years of experience is summarized in the following graph.



5. Are specific firearms assigned to specific individuals?

Ninety-three institutions provided this information. Ten of the 93 respondents (11%) indicated that they do assign firearms to specific individuals.

6. Do you have a training program for firearms use?

Ninety-two institutions provided this information. Eighty-five of the 92 (92%) respondents indicated that they had some form of training program.

If yes, please describe:

Seventy-three institutions provided the information summarized below. The largest single resource for training is local law enforcement. At least three of the institutions that provide their own in-house training have staff members certified as NRA firearms instructors. One institution provides firearms safety training for their entire staff, not just the shoot team. Training sessions range from a single gun safety class to several days of classroom and range instruction. Twenty-six institutions (36%) indicated that they had an ongoing training program, meeting at least once a year. Fifteen institutions indicated that they have an annual training session; eight others have two sessions each year. Three institutions indicate that they run monthly training sessions. Three institutions indicated that they maintain a log or record of their training.

Training Resource	# of responses	% of responses
law enforcement	36	49
other government agency training	8	11
professional training	13	18
in-house	12	16
in house police/security	4	5
total responses	73	

7. Do you have a qualification process?

Ninety-one institutions provided this information. Sixty-eight (75%) indicated that they have some form of qualification process.

If yes, please describe:

Sixty-eight of 91 respondents (75%) indicated that they have some form of qualification process. There was significant variation between zoos that required qualification. Some only required the approval of the director (9%) or previous firearms experience (7%). Twenty-five required that the shooters complete a training course (37%). Thirteen of these 25 have ongoing training programs meeting at least once a year. Thirty of the 68 institutions (44%) with qualification standards indicated that their staff must re-qualify on a regular basis. Twenty-three qualify once a year, six qualify twice, and one requires qualification four times a year.

Thirty-five of the 68 (51%) required some measurement of marksmanship or handling. Nineteen of the 35 institutions that have marksmanship and handling requirements included some details of those requirements, however they are so varied that it is not possible to summarize them in a simple table. The simplest form requires 3 shots fired at a set distance, the most complex may be time limited and involve multiple distances and shooting positions, moving targets, and require reloading. The maximum qualification range for shotgun or rifle varies from 25 to 100 yards.

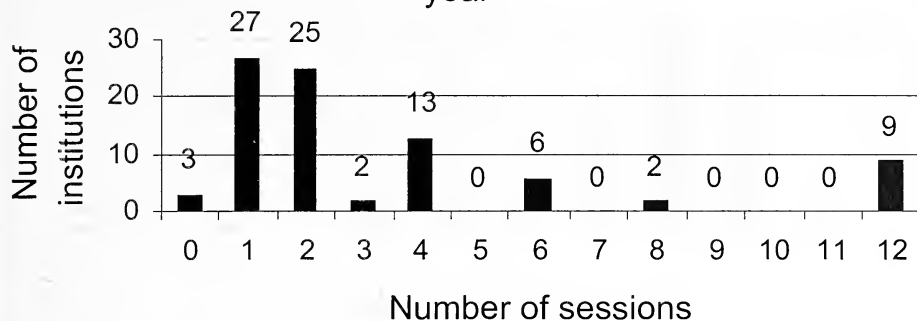
The psychological or attitude assessment required by five percent is generally an informal one made by the director or designated weapons team leader. At least one institution's governing authority has determined that only management level staff can be firearms qualified. While only one institution specifically mentioned background checks, it is highly likely that background checks would be run as part of a permit application process. Some institutions listed more than one criterion for qualification. Some institutions listed more than one criterion for qualification.

Qualification Criteria	# of responses	% of zoos
handling/marksmanship	35	51
must complete training	25	37
requires director's approval	6	9
requires other approval	6	9
written test	5	7
psychological or attitude assessment	5	7
prior experience	5	7
employment status	4	6
must obtain proper permit	3	4
volunteer	2	3
drug test	1	1
background check	1	1

8. How frequently does your staff practice with firearms?

Eighty-seven institutions provided information about the frequency of their firearms practice sessions. The minimum number of required practices ranged from zero to 12 times each year, with an average of 3.4 times per year. Fifty-five percent practice two or fewer times each year. The results are summarized on the following page.

Minimum number of required practice sessions per year



9. Do you practice with the facility's firearms?

Ninety-two institutions provided this information. Eighty-seven (95%) indicated that they practice with the zoo's emergency firearms.

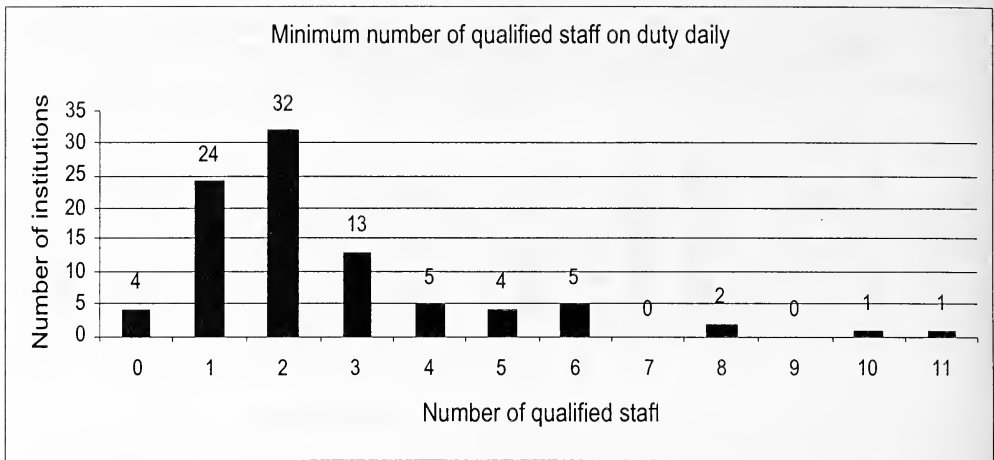
10. If you practice off-site, how is the facility covered for firearms-trained staff and weapons during this period?

This question created some confusion. Some respondents assumed the question was about liability coverage, whereas the intent was to determine who remained at the zoo to deal with emergencies during practice sessions. Eighty zoos provided the information about who remained at the zoo to deal with emergencies during practice sessions. Seventy-one percent arrange their schedule so that not all emergency staff practices off-site at one time. Sixteen institutions (20%) have no emergency coverage at the zoo during practice. Several of these institutions did indicate that their practice sites were nearby and that they remained in contact with the zoo while off grounds. One institution did note that they bring back-up firearms to the zoo while the primary weapons are gone for practice. The results are summarized below.

Emergency Coverage	# of responses	% of responses
no coverage	16	20
not all staff go at once	57	71
practice on site	5	6
use law enforcement backup	2	3
total responses	80	

11. On any given day, how many firearms-trained staff members are there on grounds?

Ninety-one institutions provided this information. The minimum number of firearms-trained staff ranged from zero to 11, with an average of 2.6. This information is summarized in the graph on following page.



12. What are your criteria for the use of deadly force?

Ninety-one institutions provided this information. There was a wide variety of responses. Most were a combination of a few basic concepts. Guarding human life was mentioned in 84%. Preventing animals from leaving zoo grounds was mentioned in 34%. Some institutions only allow deadly force to be used when specifically ordered by the person in charge (19%), others left room for the shooter to make an independent decision (4%). Six institutions (7%) specify certain animals that will be destroyed without any attempt to recapture. The results are summarized below.

Criteria	# of responses	% of zoos
human life/ safety in danger	76	84
animal leaving zoo grounds	31	34
response leader's call	17	19
shooter's call	4	4
dangerous animal	14	15
last resort	9	10
other collection animal safety	1	1
shoot on sight species	6	7

13. Do you have a "Shoot-to-Kill" list?

Ninety-one institutions provided this information. Fifty-four (59%) indicated that they did have a shoot-to-kill list.

If yes, do you specify which firearms/ammunition to use for each species?

If yes, please list species and firearms, if applicable:

Not all institutions indicated ammunition choice, so I have not included it in this summary. I assigned various species to basic categories for simplicity's sake. If a given zoo listed one weapon for lions, tigers, and leopards, that was recorded as one big cat recommendation. Some institutions may have more than one weapon recommended for a given category. This may reflect a tactical choice of shotgun versus rifle in close situations, or a difference in weapon choice for animals within the category (leopard versus lion). In that case, I recorded one recommendation per weapon. The results are summarized on following page.

animal	# of institutions	.410 ga	20 ga	12 ga	.22	.22 Mag	.223	.243	.25-30	.270	7 mm	7.62x39	.30	.300	.30-30	.30-40	.308	.30-06	.338	.375 HH Mag	.416	.44 Mag	.444 Marlin	.45-70	.425	.458	total # recommendations
big cat	41	-	-	32	-	-	-	-	-	-	2	-	1	1	-	-	1	4	2	7	-	1	1	-	-	2	54
bear	25	-	-	17	-	-	-	-	-	-	1	-	1	1	-	-	1	3	1	5	-	-	-	-	-	-	30
small carnivore	15	-	-	13	1	-	-	-	-	-	1	-	-	-	-	-	2	3	-	1	-	1	-	-	-	-	22
hoofstock	19	-	-	14	1	-	-	-	-	-	-	-	-	-	-	-	2	3	1	3	-	-	-	-	-	1	25
pachyderms	20	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	2	1	8	-	-	-	-	-	-	6	21
apes	15	-	-	12	-	-	-	1	-	-	-	-	-	-	-	-	1	3	-	4	-	-	-	-	-	-	21
monkeys	14	-	-	11	-	-	-	1	-	-	-	-	-	-	-	-	1	4	-	-	-	1	-	-	-	-	18
ratites	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3
crocodilians	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3
venomous reptiles	2	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3

14. How do you train staff for shot placement for various species?

Eighty-six institutions provided details of how they train staff for proper shot placement. Discussion during training seems to be the primary source, mentioned by 37%. Various references, which may include hunting or anatomy texts or simple photos or diagrams of dangerous animals, are used by 24%. One institution uses big game hunting videos as a training tool. Fourteen percent rely on the firearms team experience. Some zoos listed more than one source. This information is summarized below.

Resource	# of responses	% of zoos
discussion	32	37
references	21	24
team experience	12	14
animal targets	9	10
marksmanship	8	9
game agents	7	8
big game hunter	4	5
veterinarian	3	3
law enforcement	2	2
no training offered	4	5

A few institutions gave more details of their training. Sixteen indicated that they train for heart/lung shots. Four listed the head as the preferred target. Four others indicated that the primary goal was to break the animal down first, and follow-up with a killing shot, with two of these giving elephants as an example.

15. Do you employ any non-lethal tools (i.e. pepper spray, stun guns, tasers, etc.)?

Ninety-six institutions provided information about non-lethal tools available to their staff. Seventy-seven (80%) use some form of pepper spray, some only for keepers working in dangerous animal areas, others for all animal care staff. Some require keepers working in dangerous animal areas to carry it, while others offer it only to those who request it. At least one zoo has made the decision not to use pepper spray on the advice of their local law and game enforcement agencies. Forty percent listed traditional capture equipment, fire extinguishers, and water hoses. We can assume most zoos would have these items at hand and the actual number would be larger. Five zoos indicated that they

have less-than-lethal rubber or beanbag rounds for their shotguns. Some institutions had more than one response. The results are summarized below.

Non-lethal tools	# of responses	% of zoos
pepper spray	77	80
capture equipment	20	21
fire extinguishers	15	16
less than lethal ammunition	5	5
hotshot	3	3
water hoses	3	3
air horn	2	2
taser	1	1
stun gun	1	1
none	5	5

16. Do you have a designated emergency response team?

Ninety-six institutions provided this information. Seventy (73%) indicated that they have a designated emergency response team.

If yes, please describe how it is organized:

There was some confusion regarding the intent of this and the next question. I combined appropriate answers from Question 17 (deployment) with these responses for a combined total of 74 respondents. Some zoos may have had more than one response.

Emergency response organization	# of responses	% of zoos
all staff involved in response	12	16
only animal care staff respond	5	7
direction by designated capture coordinator	13	18
direction determined by chain of command	22	30
division of responsibilities by department	25	34
included tactical guidelines for response	9	12

17. How is your response team deployed in an emergency situation?

As noted previously, there was some confusion about the intent of this question. To get the full use of the information provided, some answers regarding team structure were combined with Question 16 (team organization). The remaining responses measure how staff is notified of an emergency. Due to this confusion, there are answers from only 56 institutions summarized here, and some zoos made more than one response.

Method of communication	# of responses	% of zoos
two-way radio	55	98
pager	6	11
telephone	16	29
public address system	6	11

18. Do you have separate shooting & live recovery teams for animal escapes?

Ninety-one institutions provided this information. Thirty-nine (43%) indicated that they have a separate shooting team. Two institutions noted an overlap between the shooting and recapture teams.

19. Does your facility have a security force?

Ninety-four institutions provided this information. Sixty-eight (72%) indicated that they had some type of security. The details are summarized below.

Security Options	# of responses	% of responses
have some form of security	57	61
nights only	8	9
have in-house police department	2	2
use local law enforcement	1	1
no security force	26	28
total responses	94	

If yes, please describe their responsibility in a dangerous animal escape:

Sixty-seven institutions provided this information. The primary roles of security forces reported are to provide crowd control and secure the zoo perimeter. Some institutions had more than one response. The results are summarized below.

Security's Role	total # of responses	% of zoos
crowd control	43	64
secure perimeter.	21	31
members of shoot team	17	25
communications	15	22
coordinate with police/ EMS	12	18
observation	4	6
provide 1st aid	3	4
media control	1	1
part of recapture team	1	1
not involved	3	4

20. Does your emergency team interact with local law enforcement?

Ninety-three institutions provided this information. Eighty-one (87%) indicated that they have some interaction with their local law enforcement.

If yes, please describe the role of the law enforcement including when they would be contacted and who is responsible for making the decision:

Eighty-one of 93 institutions (87%) indicated that they have some interaction with their local law enforcement. These institutions provided more detailed information regarding how and when local law enforcement would be contacted, and what role they would play. Twenty-four institutions (30%) indicated that they would only call if an escaped animal left zoo grounds, usually by the director or response leader. An equal number (30%) indicated that they would call the local police automatically.

Local law enforcement's most common role is providing firearms training (47%). Sixteen institutions (20%) rely on the police for support. Ten of these 16 may ask their police department to serve as firearms back-up. Ten zoos (12%) use their police department as their primary firearms response. Five of these zoos do not maintain any firearms, while the remaining five have firearms available if the police cannot respond in timely manner. Estimated response times ranged from 3 to 20 minutes. While several zoos indicated that the police would coordinate any response off-grounds, only one indicated that the police department would take over the response on-grounds. Eight institutions indicated that their local law enforcement would work with the zoo in recovering or destroying an escaped animal off-grounds. Four institutions indicated that they involve their local law enforcement in drills or training programs. One institution provided a copy of a patrol policy developed with their sheriff's department. It lists the potentially dangerous animals that might escape, and details how officers should respond.

Law Enforcement's Role	# of responses	% of zoos
provide training	38	47
act as support	16	20
secure perimeter	13	16
act as primary shoot team	10	12
coordinate off-grounds action	8	10
will take over response if called	1	1
are involved in zoo drills or training	4	5

21. Is the emergency team covered for liability? If yes, please describe how:

Ninety institutions provided this information. If the emergency team was covered, it was part of the regular insurance coverage provided by the zoo or governing authority. The results are summarized below.

Emergency Team Liability Coverage	# of responses	% of responses
coverage provided	79	88
no coverage provided	4	4
not sure or have some questions	7	8

22. Has anyone at your facility ever had to use firearms in an emergency situation? If yes, please describe the incident(s) briefly and evaluate the effectiveness of your response. Please indicate what changes you made or would like to make in your policies and procedures based on this incident:

Ninety-four institutions provided information about the use of firearms during real emergencies as their facilities. Seventy-one (76%) indicated that they had never had to use their firearms. Nine (10%) indicated that they had deployed their firearms, but had not had to use them. Ten zoos (11%) reported eleven incidents where they have had to use their weapons and an additional four (4%) have had law enforcement use deadly force in an animal emergency. Two institutions reported that their experience led to increased training for response; the third acquired larger firearms.

There were not many details given for these incidents, sometimes for legal reasons. Four of the incidents date back to the 1960's and 1970's. The animals involved include four big cats, three bears, three apes, two wolves, two large hoofed animals, and one not specified. In at least three of the 15 incidents (20%) the institutions using deadly force failed to kill the animal involved (a big cat, an ape, and a large hoofed animal). I believe that incident rates are low. I know of a few incidents that were not reported, and I have to believe that there have been others. This would make the actual incident rate rise, but hopefully cause the failure rate to drop. The question did not specifically ask for instances where firearms were deployed and not used. This rate may be under-reported as well.

Discussion

The results we have reported are very similar to those reported by Baker (1996) and Cook (1994) in several areas. Baker's results are based on 79 responses, Cook's on 24. The Zoo New England survey results showed that 76% of the institutions surveyed maintained firearms. Baker reported 73% in 1996. Cook reported 96%, but this may be due to the smaller sample size. It is difficult to make close comparisons based on weapon type due to the different way each survey was tabulated. All three surveys showed that 12-gauge shotguns are the most prevalent weapon available and that .375 and .30-06 rifles were the most popular rifles. In Baker's survey, however, the .30-06 outnumbered the .375. Cook reported almost equal numbers. There was some variation with regard

to training. Baker reported 62% of responding institutions had some form of training program while Cook reported 75%. Our results showed 92%. Hopefully, this increase can be attributed to increased attention to firearms issues.

All three surveys showed similar results concerning the use of deadly force. Twenty-five percent of the respondents to Cook's survey indicated that they had deployed firearms for a dangerous animal incident. Our results showed 24%. Baker found that 16% reported using deadly force. Cook's survey showed 17%. Our survey showed 15%. Each of these three surveys showed a greater than one in seven chance that a given institution will have to use deadly force at some time.

Although most institutions had a training program, this training varied from a single gun safety class to several days of training. Most supplement this with practice, however 27% of respondents require practice only once a year. The qualification process is equally varied. Twenty-five percent of respondents had no qualification process. Some institutions only require a potential firearms team member to complete a single training course while others have complex skills tests. Thirty-two percent required staff to re-qualify on at least an annual basis.

If we consider the weapons recommended on the various shoot to kill lists submitted, it becomes obvious that all responding institutions rely heavily on the 12-gauge shotgun for most circumstances. Twenty-eight percent of respondents have the 12-gauge as their only weapon. One institution in a metropolitan area reported that they recently switched to shotgun only because of safety concerns associated with using a high-powered rifle in an urban area. This is a very valid concern, but the weapon's effectiveness is of equal concern. A quick cross-reference of current ISIS mammal abstracts and our survey data show that there are 62 institutions that hold pachyderms. These results indicate that 11 (18%) do not have a weapon larger than a 12-gauge. Okimoto (1996) suggests a .458 or .416 as the minimum for an elephant, with a reminder of how poorly 12-gauge slugs performed on the escaped circus elephant in Honolulu. Barbiers and Baker (1999) specifically do not recommend using a shotgun for elephant, rhino, and large hoofstock; instead, they recommend at least a .30-06 rifle with solid ammunition.

Each zoo has to make some basic decisions about their weapons use philosophy. Some opt for the big bore guns for maximum power. Others rely on smaller rounds because the size and recoil the bigger guns can be intimidating even to experienced shooters. Some zoos elect to use one type of weapon for all circumstances, preferring the one-size-fits-all approach. Twenty-eight percent of respondents use only a 12-gauge shotgun as their primary weapon. As noted previously, because the 12-gauge round may not be an effective way to immediately kill an elephant, one zoo recommends using the 12-gauge to break down the animal and anchor it for the kill shot. Other zoos have a variety of weapons and ammunition to select from, and rely on training staff to make the appropriate selection. Concerns for staff training and ability also affect the preferred target. A head or cervical spinal cord shot is the best chance of immediately killing an animal. This can be a difficult shot to make. Many zoos recommend the heart/lung shot instead. This gives the best chance a bullet will hit a vital area, but the animal may not drop immediately. All of the firearms responses reported in this survey are the result of these kind of compromises.

The liability question was an interesting one. Does your insurance carrier know that you have guns and plan to use them if necessary? I had to ask that question at Zoo New England. The answer for us was yes. Our survey shows that four zoos either do not believe that they will be covered and seven are not sure if they will be. Like any other insurance, it is an important thing to consider before you need it. Likewise, the institutions that have well-developed relationships with their local law enforcement are also ahead of the game. It would be better that your local police department knew what to expect in case of an emergency than be surprised by zoo personnel on the streets with guns. The few institutions that have documentation of these understandings are in a much better position should anything go wrong, as are those that document training and practice sessions. In the current litigious environment, we have to be just as prepared for what happens after the emergency is over.

This survey has also shown a great variety of resources available to assist institutions that want to improve their programs. William Baker also wrote an in-depth look at weapons response that is

included in the *Resources for Crisis Management in Zoos and Other Animal Care Facilities* (Baker, 1999). He gives a good review of basic firearms and ballistics, and makes his own recommendations for emergency response choices. Baker and Okimoto (1996) offer the reminder that hunters are a great resource for this issue. Whether you agree with their ethics, it does not hurt to look to the people who have killed most of these species on a regular basis. Whether in person or through books or videos, their experience can be helpful. Four institutions indicated that they have consulted with big game hunters. Another potentially controversial resource is the NRA. No matter what you think of Charlton Heston, this organization has a variety of training courses in place, usually available at a reasonable cost. At least six institutions report using NRA courses, three have NRA certified instructors on staff.

What Does It All Mean?

Zoo New England initiated this survey because we had looked at our own firearms program and found it lacking. Many of our staff involved in dangerous animal response have limited firearms experience. We operate two zoos in a major metropolitan area under some of the most restrictive gun laws in the nation. While both of our park grounds fall under the jurisdiction of the state police, the respective city police departments have jurisdiction off-grounds. Our collection includes many dangerous animals and is growing to include more each year. We have a responsibility to ensure that we operate both zoos as safely as possible. We also have a responsibility to ourselves to make sure our policies do not expose the corporation to undue liability.

We have previously worked with the Massachusetts Environmental Police to provide a basic hunter safety class for our staff. This allowed them to apply for the state firearms identification card required to carry and use long arms. This class did not provide the practical firearms training that we believe our staff needs. We have found an enthusiastic partner in the America Firearms School in North Attleboro, Massachusetts. They have worked with us to develop a multi-level training program to cover firearms use from basic safety training to tactical shotgun training, and are developing a simulator scenario for us. We will be able to put staff through the same type of training used by law enforcement, using a of video simulation of our facilities and our animals. We have memberships at the firearms school that allow our staff access to their range for practice sessions. We have also purchased additional shotguns to allow staff to practice and still have weapons available on zoo grounds. All of our guns are the same make and model to prevent confusion.

Soon, all of our dangerous animal response team members will have acquired their state firearms identification cards that will allow them to legally transport and use our weapons once they complete additional training and qualification. We have met with the Colonel of the Massachusetts State Police to discuss our firearms program and have received great cooperation. We are working toward developing an official memorandum of understanding with the state police regarding our firearms policies, and plan to do the same with our city police departments.

Conclusion

Every institution faces a different set of circumstances. As this survey has shown, each one has responded to those circumstances in a different way. There are no set standards within the AZA for minimum levels of training, staffing, or even type of weapons. Each institution must make certain that they have proper weapons and training to protect their staff, guests, and neighbors in event of an incident involving a dangerous animal.

Although 92% of responding institutions require firearms training, only 36% indicated that they maintain an ongoing training program at least once a year. Thirty-five percent of responding institutions practice once or less each year. Seventy-five percent of responding institutions have some form of qualification process, but almost half of these do not require some form of skills test. There was great variation in the requirements for those that did.

Some of the most important numbers we have reported are the incidence rates of firearms use. Our results suggest that a given institution has almost a one in four chance of deploying firearms for an emergency incident, and about a one in seven chance of having to pull the trigger. Many of us can think of additional incidents that were not reported that could make these incidence rates even higher. The failure rate for firearms use as reported was 20%. Even if factoring in the additional

unreported incidents causes this figure to decrease, these numbers should serve as inspiration for all institutions to take a closer look at their training and equipment.

Acknowledgements

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Aspects of a Safety Program for Zoo and Aquarium Facilities in the United States

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In this day in age, it is generally assumed that most animal related facilities would have a comprehensive Safety Program, with hazard assessments, and job specific training in place for their employees. But after I switched careers from the zoo profession to the safety profession, my research and discussions find that most animal safety programs concentrate on personal safety with regard to animal interaction, but lack attention on specific federal Occupational Safety and Health Administration (OSHA) areas of emphasis and concern.

Animal facility safety programs concentrate upon the safety of the person in direct contact with exotic and dangerous animals. This is obviously an important aspect of safety training in the zoo or aquarium field. What should receive even more attention in the facility safety program is the need for documented safety training *before* the animal keeper is expected to perform any tasks. There is also the need to conclude the training with a written performance test, and the need to provide additional training, on at least an annual basis.

A zoo keeper or aquarist is covered under the OSHA Federal 29 CFR Part 1910 or General Industry Standards. Due to the nature of the job the OSHA Standards covered under 29 CFR 1926 for the Construction Industry may also be applied. Approximately 50% of the states within the U.S. have their own "State Plan". For the most part, those states have simply adopted the Federal Standards. If you happen to work in the State of California, then the Cal-OSHA Standards are usually stricter than Federal OSHA Standards.

There are three principle areas of an effective safety program for zoos or aquariums:

1. A **Written Safety Program** that covers basic employee safety, specialized safety programs, hazard communication, evacuation plans, first aid, public safety and chain of command. This is a "living document", one that changes frequently with the addition/subtraction of species, enclosures and job titles/tasks.
2. A **Job Hazard Assessment (JHA)** should be performed for every job title within the organization and for zoo keepers, the hazards of working with chemicals, or conditions and specific species (elephants, apes, macaques) should be identified separately and the species management plans included in the program. The JHA should concentrate on the specific Personal Protective Equipment (PPE) and training needed by the employee to safety and effectively perform their jobs.
3. **Initial and Annual Safety Training** are required for basic elements of a safety program and specific training is required *before* new methods, equipment or chemicals are introduced to the employee.

Safety Program

This is a dynamic document that needs *annual (minimum) review* by the safety managers and/or curatorial staff. A copy of the plan should be located in every manager's office and should be readily available to every member of your staff.

The basic elements of a written Safety Program should contain:

- A list of the management hierarchy and *current* contact phone information
- A list of staff (or reference the location where a current staff list is kept)
- A map of the facility
- Evacuation Plans (or reference to the location of these documents)
- Bomb threat, Bio-terrorism threat, Weapons of Mass Destruction (WMD) threat plans
- First Aid procedures for staff and visitors
- Location of the OSHA 300 and 300A Reportable Injury Logs and responsible party
- Copies of blank Industrial Injury reporting form(s) (or equivalent)
- Hazard Communication Program (or reference to the location of the document). This is a list of your chemical inventory, location of chemicals, MSDS and Spill Control Procedures, including the person in charge of managing the chemical and MSDS inventory.
- Employee Training Materials (or reference to the location of these documents)
- Specific written Animal Safety Programs (Elephant contact, Primate Management etc., or reference to the location of these programs)
- Specific written Equipment Safety Programs (Bloodborne Pathogens, Forklift, Fall Protection, Hearing Conservation, Confined Space, Commercial Diving, etc)
- Copies of any applicable blank safety permit needed to work within the facility (Confined Space Permit, Hot Work Permit, etc.)
- A list of the training offered to employees and a synopsis of content
- A description of how all training and testing are documented and recorded
- A description of how unsafe employee actions are documented and the disciplinary procedure followed (or reference to the location of these documents). OSHA considers the internal disciplinary process to be a vital element of an effective safety program.

Job Hazard Assessment

A Job Hazard Assessment (JHA) should be performed for every position in the facility. A JHA will breakdown every aspect of the job and the equipment and protection needed by the employee to safely perform each task. For instance, the selection of Personal Protective Equipment (PPE) needed for a keeper working with macaques will be far different than the PPE required for the Commissary Keeper.

OSHA requires that a PPE assessment cover the following areas:

- Eye Protection – OSHA has adopted the testing performed by the American National Standards Institute (ANSI). Eye protection is required PPE for employees working with chemicals. Example: disinfecting agents. It is also required for employees that are subject to a potential

bloodborne pathogen exposure. Example: bodily fluids from a macaque. Eye protection will be stamped with the mark Z87.1 or starting 1 January 2004, Z87.1-2003. Both safety glasses and goggles will be stamped if they meet the ANSI Standards for impact. **Note that the use of a face shield by itself does not meet the OSHA/ANSI Standard for eye protection.** Face shields are used to protect the face, but may be used to supplement ANSI stamped eye protection.

- Head Protection – Zoo keepers and aquarists are not normally required to wear head protection when performing their daily tasks. For other maintenance workers, or when animal keepers/supervisors are performing construction related or tree trimming tasks, only head protection marked with the ANSI Standard Z89.1 or Z89.1-2003 is approved for wear by OSHA.
- Hand Protection – Both leather and disposable latex (or equivalent) gloves should be standard issue to animal keepers. Leather protects the hands from common tasks, while the latex or latex equivalent provides protection against bloodborne pathogens. Leather alone will not provide protection against bloodborne pathogens, but latex or equivalent can be worn underneath leather to provide optimum protection.
- Respiratory Protection – Respirators are not a standard element of PPE for the zoo keeper or aquarist, but may be required for other job elements (pesticide/herbicide application) in your facility. A Respirator Program requires a specialized medical assessment and certified annual qualitative and quantitative fit testing performed by a competent person. Half mask respirators with an organic type filter cartridge are *recommended* for a pregnant animal keeper working with carnivores who risks a potential exposure to toxoplasmosis.

Suggested emphasis areas of attention for PPE:

- Skin Protection – Sunscreen and insect protection should be made available to all employees.
- Specialized Clothing – Clothing such as surgical garb, chemical suits, booties, non-conductive head/eye wear/gloves etc., are mandatory when identified by a JHA to protect employees exposed to certain hazards. With limited exceptions, the employer must provide additional equipment or clothing as identified, at no cost to the employee.
- Foot Protection – Steel toed boots and rubber steel toed boots should be standard issue for zoo keepers. For aquarists, shoes that afford the best possible traction, regardless of toe protection is preferred. Steel shank or metatarsal guards are not normally required for keepers, but may be desired for other positions.
- Hearing Protection – Hearing protection is required *only* if it is part of a Hearing Conservation Plan. A Hearing Conservation Plan calls for baseline testing for each employee and annual employee testing thereafter. The plan also requires initial site testing and monitoring by a certified Industrial Hygienist (or equivalent) and posting of the appropriate warning signs. The testing is then extrapolated over an 8-hour period. This is called Time Weighted Average (TWA) and the formula gauges the impact of the decibel level on the employee. It is important to note that ear plugs are not hearing protection and only reduce the ambient sound level by about 5db.

With the exception of prescription safety eyewear or safety shoes, employers are tasked to provide PPE for their employees at no cost. OSHA requires that Personal Protective Equipment should be readily accessible and replaced when needed. Employees should receive specific training on how to don, doff, adjust and understand the limitations of PPE. Where employees provide their own equipment, it is the responsibility of the employer to assure such equipment is adequate.

Training

A minimum of eight (8) hours of initial safety training should be offered to each new employee in the animal profession *before* they are assigned to work in the field. These are General Industry (29 CFR 1910) standards that would apply to animal facilities.

They include:

- Subpart E Contains: **Employee Emergency Plans and Fire Prevention**
- Subpart G Contains: **Hearing Protection** (A Hearing Conservation Program is dependent upon analysis of the work environment)
- Subpart H **Hazardous Materials**
- Subpart I **Personal Protective Equipment** (as delineated by the Job Hazard Assessment). A Tuberculosis module should be included for those facilities with great apes and elephants
- Subpart J Contains: **Confined Space** training (especially for aquariums), if employees are expected to enter below ground maintenance areas, sumps or above/below ground tanks for routine service
- Subpart K **First Aid**
- Subpart L Contains: **Portable Fire Extinguishers**
- Subpart N **Materials and Handling**
- Subpart O **Machinery and Machine Guarding**
- Subpart T **Commercial Diving Operations** (if applicable)
- Subpart Z Contains: **Asbestos, Bloodborne Pathogens and Hazard Communication**

The training can be offered in any format, such as lecture, video or slides. It is recommended that the employees receive written testing on the materials (after each module or at the conclusion) and the training is documented by the employee's signature. Lesson plans, test results, and documentation should be kept on file for a minimum of three (3) years. If your facility is subject to an OSHA inspection, three years prior is the usually the maximum they will look for when reviewing employee training records. Any medical testing (example: TB) or vaccinations (example: Hepatitis) documentation should be kept for the complete term of employment plus thirty (30) years.

At a minimum, a zoo keeper or aquarist should receive annual training on the subjects of Fire Protection (fire extinguishers), Hazard Communication, Bloodborne Pathogens, and Asbestos exposure. Asbestos awareness is an OSHA emphasis point and awareness training is usually dependent on the age of your facility. Asbestos Containing Materials (ACM) greater than 1% are normally found in buildings or materials constructed prior to 1972. Practical training should also be offered on Animal Escape Procedures or Plans, facility evacuation, and First aid/CPR on an annual basis.

Once this training program is in place it should be combined with a plan for facility audits (internal safety inspections) that look for potential workplace hazards. Once you have these basic elements in place, then you have the foundation for an effective Safety Program.

Emergency Contact Information/Notes

Editors' Biographies

W. K. Baker, Jr.

Bill received his Bachelor of Science in Wildlife Management from West Texas State University in 1989 followed by his post-graduate work in Zoology. His areas of research are crisis management, zoological safety, and animal behavior, which draws upon his experience as a Zoologist, PADI Rescue Diver, AGFC and TPWD Hunter Safety Instructor, NRA Firearms Instructor, Safe Capture graduate, and Red Cross CPR/First Aid Instructor. He is also a past member of *Who's Who of Professional Management*.

Bill has been active in the fields of wildlife management and zoology for many years, and has worked at numerous universities and zoological facilities in the Southwest. His experience includes positions as Lab and Museum Assistant, Shoot Team Leader, ERT Member, Large Mammal Keeper, Elephant and Marine Mammal Trainer, Senior Keeper, and Zoo Curator. He also operates *Panthera Research*, a consulting and research firm specializing in exotic felid husbandry, ethology, and training.

Currently, he serves on the AZA Antelope Taxon Advisory Group, the Sanctuary Standards of Care and Operations work group, the Maned Wolf SSP Management Committee, and is a Contributing Author to the AZA Jaguar SSP Husbandry Manual and Associate Editor for the AAZK book "*Resources for Crisis Management for Zoos and Other Animal Care Facilities*". He has also been known on rare occasions to bark and purr at cougars.

Bill is currently the Director of the Abilene Zoological Gardens, Abilene, TX.

Susan D. Chan

Susan grew up as an "Air Force Brat" traveling the world with her family and attending 23 different schools before graduating from college. She received a degree in Journalism from the University of North Dakota in 1967. Following graduation Susan worked as a reporter on the Tucson American newspaper and as managing editor of The Tucson Weekly Pictorial before moving to Topeka, KS with her husband, Gary. In Topeka she worked for Admas Business Forms as editor for their employee newsletter and public relations publications. She became involved as a Docent at the Topeka Zoo in 1978 where she was editor of Cowabunga News, the docent newsletter. She also served on the Friends of the Topeka Zoo Board of Directors for six years, two as President. She was volunteer events coordinator for many of the zoo's special events, including the Koala Kaper, Festival of Elephants, and the opening of the Discovering Apes Complex.

Susan came to work for AAZK in 1981 as Managing Editor for Animal Keepers' Forum. She has been responsible for producing the monthly journal, all national conference proceedings, assisting with the production of the Zoo Infant Development Notebook, The AAZK Diet Notebook, the Zoonotic Diseases Handbook, Biological Values for Selected Mammals Notebook, and served as editor for Resources for Crisis Management in Zoos and Other Animal Care Facilities. During her tenure as editor, Susan has produced a number of dedicated issues of the journal including ones on Enrichment, Hand-Rearing, Bat Husbandry, Duiker Management, Cheetah Husbandry and Conservation, Polar Bears and this issue on Crisis Management.

One of her most memorable zoo-related experiences was in helping to hand-rear two infant Bornean orangutans, Rudy and Joseph, at her home. In doing so, she earned the name of "Orangu-nanny".

Resource Publications Available from the AAZK Website ~ www.aazk.org

The following resource publications and dedicated issues of *Animal Keepers' Forum* are available for purchase from the AAZK website:

Biological Information on Selected Mammals

4th Edition CD-ROM Version

The 1,396 page Biological Information on Selected Mammal Species CD covers a wide range from general, breeding, and young-rearing behavior to diet and physical descriptions of 590 species. The volume is in a PDF format allowing searches by Species (Common or Latin name); or Key words using the Find function; or by Species (Common or Latin name), Family; or Order using the Bookmarks. Table of Contents are given for Orders, Families, Species by Common Name, Species by Scientific Name, and Species by Order and Family. The Appendices cover a variety of information from behavioral patterns common to families (Bovid displays) to taxonomy (Primates). References are listed by Order and Family. Prices: AAZK Members \$15 Nonmembers \$40 - Price includes Domestic and Canadian First Class Postage. Overseas orders should add \$5.00 per CD for Air Mail Postage.

AAZK Enrichment Notebook, Third Edition

CDROM Version

This 455-page publication includes many facets of animal enrichment and is indexed for easy reference. The sections include an Overview of Enrichment, Enrichment Links, Enrichment Suppliers, Suggested Guidelines (Bats, Bears, Birds, Carnivores, Fishes, Primates, Reptiles, and Ungulates), Safety Considerations, Lists of Browse Plants and Toxic Plants, Cookbook Recipes for Enrichment, Enrichment Ideas/Devices (organized by category), Sample Enrichment Forms currently used in zoological facilities, and an extensive Enrichment Bibliography. This is a searchable PDF format document utilizing Acrobat Reader that is included. Prices: AAZK Members \$15 Nonmembers \$40 - Price includes Domestic and Canadian First Class Postage. Overseas orders should add \$5.00 per CD for Air Mail Postage.

Zoonotic Diseases - 3rd Edition - CD-ROM Version

Searchable PDF Format

Hyper-linked Zoonotic Disease List

Updated Guidelines for Animal Care Personnel

Updated Hygiene and Disinfection Section

82 pages of Information

AAZK Member Price \$9.50 (includes s/h in U.S. and Canada). Non-member Price \$12.00 (includes s/h in U.S. and Canada). Orders outside U.S. and Canada need to add \$5.00 postage per CD for Air Mail service.

Dedicated Cheetah Issue - The combined July/August 2005 issue of *Animal Keepers' Forum* is a special 124-page edition dedicated to the cheetah. This issue covers many aspects concerning the cheetah ~ from captive husbandry to conservation efforts in Africa. A limited number of extra copies of this special issue are available for purchase from the AAZK Administrative Office. Cost is \$10.00US per copy; domestic postage is included. Overseas orders are \$20.00US and includes airmail delivery.

Dedicated Polar Bear Issue - The August 2007 issue of *Animal Keepers' Forum* is a special 80-page edition dedicated to the Polar Bear. This issue covers many aspects concerning the polar bear ~ from captive husbandry to conservation efforts, to the impacts of global warming on this species. AAZK worked cooperatively with Polar Bears International in the production of this special issue. A limited number of extra copies of this special issue are available for purchase from the AAZK Administrative Office. Cost is \$10.00US per copy; domestic postage is included. Overseas orders are \$20.00US and includes airmail delivery.

Dedicated Crisis Management Issue - Additional copies of this 136-page Oct/Nov 2007 issue of *Animal Keepers' Forum* dedicated to crisis management in zoos may be purchased from the AAZK Administrative Office. Price is \$25 for AAZK members and \$50 for nonmembers. Prices include postage.

All publications may also be ordered using Visa or Mastercard by calling 785-273-9149 weekdays.



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